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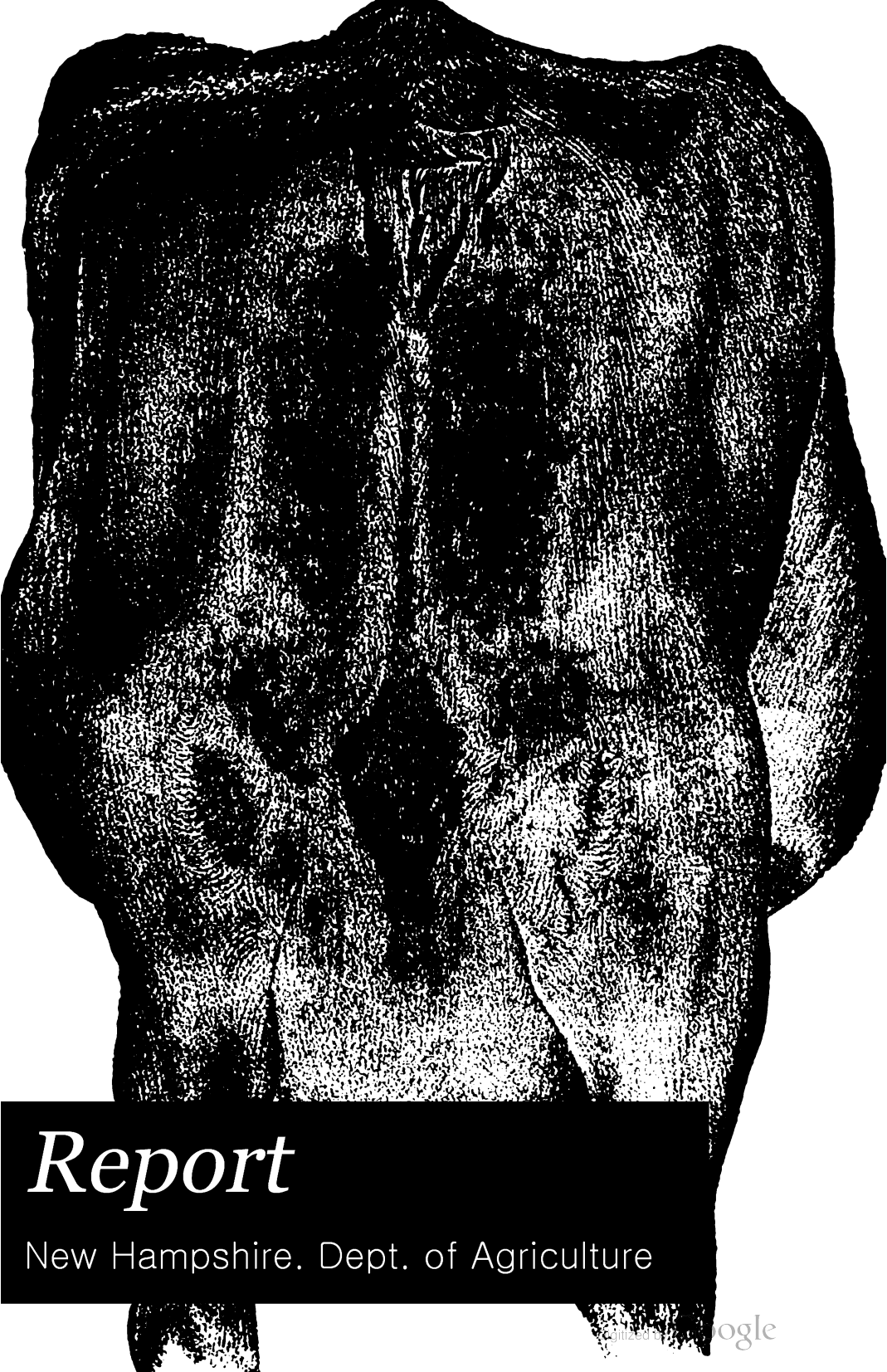

Report

New Hampshire. Dept. of Agriculture

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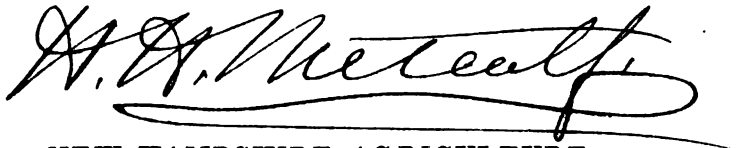

NEW HAMPSHIRE AGRICULTURE.

NINTH ANNUAL REPORT

OF THE

BOARD OF AGRICULTURE,

FOR THE YEAR 1879.

BY JAMES O. ADAMS,
SECRETARY.

MANCHESTER:
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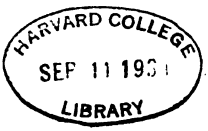

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BOARD OF AGRICULTURE.

ORGANIZED AUGUST, 1870.

MEMBERS.

MOSES HUMPHREY, Concord, *Chairman*	1870–1882
JAMES O. ADAMS, Manchester, *Secretary*	1870–1882
JEREMIAH W. SANBORN, Lower Gilmanton	1872–1882
WILLIAM H. H. MASON, Moultonborough	1879–1882
HIRAM PARKER, Lempster	1875–1881
BARTON G. TOWNE, Lancaster	1876–1882
GEORGE K. HARVEY, Surry	1877–1883
WILLIAM H. HILLS, Plaistow	1878–1881
ALBERT DEMERITTE, Durham	1878–1881
DAVID H. GOODELL, Antrim	1879–1882
CHARLES M. TUTTLE, Littleton	1879–1882

FORMER MEMBERS.

ROCKINGHAM COUNTY.

J. FRANK LAWRENCE, Epping, appointed 1870, re-appointed 1873, resigned January, 1875.

JOHN F. FRENCH, North Hampton, appointed March, 1875, declined.

JOHN M. WEARE, Seabrook, appointed 1875, term expired 1878.

STRAFFORD COUNTY.

CHARLES JONES, Milton, appointed 1870, resigned March, 1871, and died 1872.

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HIRAM R. ROBERTS, Rollinsford, appointed 1871, re-appointed 1874, resigned 1875, and died May 30, 1876.

MOSES D. PAGE, Dover, was appointed his successor, but declined the position.

JOHN H. PRAY, Rochester, was subsequently appointed and declined.

JOSHUA B. SMITH, Durham, appointed 1875, and declined a re-appointment.

CARROLL COUNTY.

WILLIAM H. H. MASON, Moultonborough, appointed 1870, re-appointed 1873, declined re-appointment 1876, re-appointed 1879.

SAMUEL B. SHACKFORD, Conway, appointed 1876, declined re-appointment 1879.

BELKNAP COUNTY.

THOMAS J. WHIPPLE, Laconia, appointed 1870, declined.

THOMAS COGSWELL, Gilmanton, appointed 1871, resigned 1872.

HILLSBOROUGH COUNTY.

JAMES O. ADAMS, Manchester, appointed 1870, declined re-appointment 1873.

BENJAMIN F. HUTCHINSON, Milford, appointed 1873, re-appointed 1876.

CHESHIRE COUNTY.

S. W. BUFFUM, Winchester, appointed 1870, re-appointed 1873.

JOSEPH M. WOOD, Alstead, appointed 1876, and died soon after.

SULLIVAN COUNTY.

EDWARD H. BROWN, Croydon, appointed 1870, resigned 1871.

JOHN S. WALKER, Claremont, appointed 1871, for an unexpired term.

EDMUND BURKE, Newport, appointed 1873, resigned 1875.

GRAFTON COUNTY.

LUTHER B. HOSKINS, Lyman, appointed 1870, resigned 1872.

JOSEPH D. WEEKS, Canaan, appointed, but declined.

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D. C. CHURCHILL, Lyme, appointed, but declined.

CHARLES F. KINGSBURY, Lyme, appointed 1872, for unexpired term, re-appointed 1873 and 1876.

COOS COUNTY.

NATHAN R. PERKINS, Jefferson, appointed 1870, declined re-appointment.

HORACE F. HOLTON, Lancaster, appointed 1873, did not desire re-appointment.

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INTRODUCTION AND REVIEW.

THE Secretary herewith submits the ninth annual report of the Board of Agriculture.

Nominally, the report covers a complete year of official duties which may begin and end at somewhat irregular periods, depending on varying circumstances. But it is more in accordance with nature's operations, by which we must be largely influenced in our work, that the civil year be accepted as the limit of time embraced in our annual record.

We therefore include, in our review of labor performed and results achieved, a period of rest to the soil, but of most active work in our official capacity; the opening of a new season of physical effort, followed by days and weeks of plant germination, growth, and continued development, and, under favorable influences, of full maturity and gathered harvests.

During the year, we have prosecuted work previously commenced, and initiated new and profitable practices. Our visits to fairs, farmers' clubs, and agricultural conventions have not been relaxed, and our public meetings in the several counties of the State have been fully sustained, and given evidence of an increased interest among the people.

We have found a greater desire to learn better methods of husbandry, and a more ready adoption of new practices on the farm. There is seen an adaptation of crops to soils and circumstances, to a far greater degree than in former years. Men are getting rapidly out of the old ruts, in this respect, as well as others; are studying the nature and effects of their annual cropping of the soil, and are more readily accepting the teachings which science has presented and practical experiment proved.

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The intelligent farmer of to-day will not carry away from the soil, in gathered harvests, more plant-making material than can be replaced, after deducting the cost of their production, by the money they will bring him. He has begun to learn the nature of every product of his farm, whether it be produced from the soil directly, or come more remotely therefrom through the agency of his domestic animals. If he removes the material for plant-growth, he wisely replaces it; and if he would reap an increased harvest, he adds a liberal annual interest to the capital stock with which he began.

If there is one indication on our worn farms just now more promising than any other, it is the demand, coming in every direction, to know what and how to furnish the soil, at minimum cost, with the material for producing maximum harvests. This is the essential question of the day with those who are endeavoring to build up our agricultural interests. All over the State our tillers of the soil are striving to solve the problem, and never so earnestly as during the preceding year.

Everywhere there are found improved implements, and, consequently, a more economical and thorough tillage of the soil, and more gratifying, and, we are sure, more profitable farm management, throughout the State. Old tools have been laid aside, and those which change the burden of labor from man to beast have been substituted, on those farms where the largest profits are made. Even the farm implements of the last decade are now antiquated. The swivel-plow, the improved land-side, the sulky, and the gang plows are soon to be seen, even on the rocky hill-sides of our State; while pulverizing harrows will send the old "spike-tooth" to ancient collections in museums or to the "junk-store." Already, fertilizer-distributors and manure-spreaders, operated by animal power, are found on our most productive farms. Seed-sowers and planters, with horse and man accompaniment, are each to do daily the work of ten, yea, twenty, farm-hands. The old hand-hoe, over which many an aching form has rested, may now itself take rest; for the husbandman, seated on his smoothing-harrow, may once a week go over his corn-field at one-tenth the cost required to run the plow, or even the cultivator, between rows, and wholly dispense

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with the hand-hoe, on at least one-half the corn-land that we till.

Need we mention other implements, — the mower, the tedder, hay-loaders, corn-huskers, potato-diggers, and grain separators? Need we come into the house and marshal the many improved utensils of the kitchen, the dairy, and even of the nursery and sitting-room? They are found, but too rarely, in all sections of the State. The census ten years hence will present a wider contrast with that of the present year than has ever yet been seen in one decade.

The introduction of labor-saving implements has inaugurated a system of farm betterments which may well be classed under the head of "internal improvements." To welcome them to successful work on the hard and broken surface of our State, our people have begun to see the importance of smoother fields and less obstruction in the form of fences, bowlders, unbroken borders, and unsubdued valleys, productive of wild and worthless weeds or unfriendly shrubs and useless bushes. These are destined to give place to cultivated areas and to profitable crops. These bowlders are to be removed or sunk into the earth, or the places they occupy must be given up to wood growth. These low grounds, to be under-drained and "vexed" by the plow, are to yield abundant vegetation. These old walls are to be removed; these banks by their sides, the accumulations of years of repeated plowings, are to be broken up; and the plowshare is to "extend its area of freedom" in larger, broader, and more productive furrows.

This work has already been initiated, and, on many farms, carried on to successful results. The ten years of our existence as a Board of Agriculture, especially the past year, have witnessed grateful improvements in this direction, stimulated and encouraged by our constant teaching.

Though it is difficult to mark exact limits to the results of natural causes, or even to the results of any direct effort in any department of husbandry, we have good reason to report far greater and better results in the breeding and care of domestic animals during the year than for any equal time preceding. We have never, at any one time, been able to report so large a

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number of blood or grade cattle as at present. There is scarce a town whose neat stock does not give evidence of this improvement. Though this is perhaps more apparent in this class of our domestic animals, it exists in all other classes. We are making advanced records in the quality of our horses; we have a better class of sheep, though not as many in number, than we have had at previous dates; our swine are wonderfully improved and are yearly improving; and our poultry-yards are many times more important than they were ten years ago. The eggs and poultry produced in the State during the year have been carefully estimated to be worth two millions of dollars. Not only have we better blood and better-bred animals on our farms, but we have learned, quite recently, to feed more economically and successfully, and are beginning to realize an advantage in the practice. It is an element in our work as farmers, that we feed according to the demands of our animals, and make such a combination of foods as will build up the animal we desire to grow, or give the products we seek.

These advancements in the art of husbandry, and others of a similar character, are such as result from continued action on the part of those who anticipate the necessities of the vocation, and, by their position, official or voluntary, aid and encourage the toiling tiller of the soil. We could dwell long on these and kindred results in the broad field in which we are called to work, but we are admonished by the increasing figures at the heading of our pages to turn from these inviting topics, name briefly the leading specialties which have claimed our notice during the year, and proceed to the more important chapters of our report.

In our last report we gave the people of the State reason to anticipate the working, on a small scale, of an experimental station, before the publication of these pages. In fact, we had arranged, through a committee of our Board and a committee of the trustees of the College of Agriculture, a plan, which was unanimously accepted by the joint committee, by which a station should be sustained jointly, with very small expense. But the trustees neglected or refused to ratify the action of their committee, and the measure failed.

The plan was briefly this: The college should continue the

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work of experiment on the farm, as it now continues to do; the Board should make thorough and extended tests of seeds, plants, fruits, and other articles of interest to the farmer; an examination of fertilizers, soils, vegetables, grains, and the like, should be made in the laboratory of the college, the Board, as authorized by law, to meet the actual cost. This would virtually cause no expense to the college, and would give it the credit of doing as good service in its chemical department as it has been practically doing on the farm.

This failing, this Board arranged with the president, secretary, and professor of chemistry of the college, to present to the Legislature a bill providing for the examination of fertilizers and such other articles as the interests of agriculture required, in the college laboratory, the revenue from the licensing of the sale of fertilizers going to defray the expenses. The bill was unanimously passed, and is now a law of the State. But circumstances have prevented the execution of the work, and the people have not received the benefit that was anticipated. A work that would greatly benefit the college and promote the agricultural interest of the State could be easily prosecuted at the college, if all the trustees could see the importance of it, as a portion of them readily admit it.

This statute, with that pertaining to the licensing of the sale of trees and plants, has brought into the state treasury one thousand dollars, and has insured a better class of articles in the several branches they were designed to reach. The Board is authorized to expend the revenue from the license of trees and plants in testing seeds and plants, and it is in contemplation to procure the German sprouting-apparatus, or some other facilities for carrying into effect the provisions of the law in this respect.

The Board, under the authority of the original act, as well as under the special law of the present Legislature, has made some progress in analyzing grains, grasses, fertilizers, muck, and peat, as will appear in the body of the book. Much more will be accomplished in the year to come, if the College of Agriculture is prepared to do its part of the duty.

During the current year, our State, which, until recently, has

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been almost wholly exempt from serious diseases of domestic animals, has had repeated visitations of disease among neat stock and swine, which in many cases have caused great loss to individual farmers. These cases will appear fully reported by the proper authorities in this volume, as will also many other matters that we need not discuss in these prefatory pages.

Respectfully submitted in behalf of the Board.

JAMES O. ADAMS, *Secretary.*

May 1, 1880.

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NEW HAMPSHIRE AGRICULTURE.

MEETINGS OF THE BOARD.

CONTINUING the established custom, the Board has held but one formal business meeting during the year, the decision of all minor matters being left to the Chairman, the Secretary, and the member from the county in which any question may arise.

The meeting the current year, being the annual one, was held at Dover, Sept. 17, on one of the days of the state fair. There were present, Messrs. Shackford, Harvey, Parker, Hills, and DeMeritte, whose term of office had not expired; Messrs. Humphrey, Towne, and Sanborn, re-appointed; and Mr. Goodell, new member. Dr. Mason, appointed to succeed Mr. Shackford in Carroll County, and Dr. Tuttle, the successor of Dr. Kingsbury in Grafton County, were not in attendance. Messrs. Towne, Sanborn, and Goodell were sworn before justices of the peace and quorum, Moses Humphrey and J. O. Adams. Mr. Humphrey presented a certificate of qualification from the secretary of state.

On proceeding to ballot for Chairman, Moses Humphrey received seven votes, the full number cast, and was declared elected by the Secretary of the Board. A ballot taken for Secretary resulted in the unanimous election of James O. Adams, who was sworn by the Chairman.

Records of the last annual meeting were read and accepted, and the action of the Chairman and Secretary, sub-committees and county members, was approved so far as they had taken the responsibility to decide matters which should properly be determined, whenever practicable, by the Board.

A plan of work was initiated and referred to appropriate committees. It was voted to continue the practice of holding

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meetings, and to announce from two to four in each county, or an average of three to a county.

It was voted that the Secretary attend all meetings; that each member be present at those held in his own county; and that meetings of not more than one full session each be conducted by these officials, one additional member being added to the force for each extra session; the Chairman, Secretary, and member in the county where the meetings are held, to determine the places and make all needed arrangements.

Messrs. Humphrey, Sanborn, and Adams, a committee to confer with a committee of the College of Agriculture, with reference to experimental work, reported, that, although they agreed on a plan of work agreeable to both parties, there was no probability of accomplishing the object, on account of a neglect on the part of the college trustees to take action in the matter, or to approve the action of their committee.

It was voted to organize committees on various matters, to consist each of two members and the Secretary, to which questions should be referred for action. The following assignment was made: —

Finance. — Messrs. Humphrey and Parker.

Experimental Work, including Investigations regarding Seeds and Fertilizers. — Messrs. Sanborn and Hills.

Farm Machinery. — Messrs. DeMeritte and Goodell.

Hygiene and Diseases of Animals. — Messrs. Mason and Tuttle.

Horses. — Messrs. Towne and Humphrey.

Neat Cattle. — Messrs. Goodell and Sanborn.

Sheep, Swine, and Poultry. — Messrs. Harvey and Mason.

Dairy, and all Kindred Matters. — Messrs. Tuttle and DeMeritte.

Fruit and Vegetables, including all that pertains thereto. — Messrs. Hills and Harvey.

General Matters. — Messrs. Parker and Towne.

After a general discussion on the work in hand, the Board adjourned.

MEETINGS IN COOS COUNTY.

The meetings of the Board in Coos County the present year have been held in small towns, and have been conducted by

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Mr. Towne, the county member, and the Secretary. They have generally been well attended, and characterized by a lively interest. They have been held in Dalton, Dummer, Berlin, Milan, West Milan, and Stark; numerically more than an equitable proportion.

None of these towns have ever before had meetings under the direction of the Board, though three years ago Milan and Berlin were visited by members in the midst of one of the severest storms recorded there. The attendance was very limited, and the meetings quite informal. This year the visit was made in October, during good weather, and the result was very gratifying. The topics discussed were live stock, grass, forage, implements, manures, the dairy, and kindred topics, usually such as the state of the farming interest required. The people there have not been compelled to use commercial fertilizers, but have done better to trust to the unexhausted fertility of the soil and the natural fertilizers from their domestic animals. They are, however, beginning to find their potato-yield falling from three hundred and fifty to two hundred and fifty bushels per acre, their oats from eighty to fifty bushels, and their grass-fields from two tons natural product to one-half that amount; and therefore they are using plaster-paris, and making earnest inquiry in regard to guano, dried blood, ground bone, and chemical compounds.

Potatoes bring at the starch-mills only twenty-two cents, which is by no means a paying price. Though a large per cent of the tuber is water, still their cultivation reduces the producing capacity of the soil, and their removal carries away more fertility than can be replaced by the money they now bring. This fact was demonstrated by the discussions at these meetings.

Another important interest which was discussed in nearly every place, is dairying. Members of the Board report, that, at public house and private residence, wherever they were entertained, they found excellent butter. All summer the price seldom rose above fifteen cents a pound, while the average for the season was but thirteen or fourteen cents. The farmers were urged to keep better cows, feed well, — the pastures and running streams being favorable, — to exercise more care of cows,

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and practice rigid neatness in the handling of milk and the manner of putting up butter.

Oats and buckwheat are two great crops throughout the county, but the former, like potatoes, are leaving the soil poorer year by year, whenever grown. The Board advised to put the hay-crop nearer the manure, so as to get a better profit from the hay-field. Hay sells readily for from ten to fifteen dollars per ton, for the hotel-stable and the lumberman's camp in the forests. Mr. Towne related his experience in fall seeding to grass without the intervention of oats. He makes an excellent showing by his practice.

Wheat is widely cultivated and very profitably on all the highlands. Barley has not been largely grown, and the seasons are generally too short for corn. We noticed many fields of sugar-beets and mangolds.

In some sections of Coos, notably in Colebrook, there has been a wonderful improvement in neat stock, through the recent introduction of Shorthorn blood. In the eastern section, aside from the great work which has been done at Shelburne by Judge Burbank, but little credit can be given the breeders of stock.

At Stark the people are wide-awake, and at the close of the meeting organized a farmers' club.

MEETING AT WEBSTER.

On the afternoon and evening of Nov. 11, the Board was represented at Webster by Messrs. Humphrey and Adams, who were aided by the willing head and hand of Mr. Walker, of Concord. A full report of the proceedings was made for the "People and Patriot," by J. O. Lyford, Esq., which is here given with limited modifications.

The Board of Agriculture made its first appearance at Webster on Tuesday of last week. It was not expected that a large audience would meet there in the afternoon, on account of the attention that the town fathers and interested citizens were devoting to the several bridges in that locality; but, to their surprise, a good and attentive audience met and discussed with them the agricultural topics assigned for the meeting. Mr.

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James L. Gerrish, Dea. Sanborn, and others brought in butter, oats, potatoes, and corn, for exhibition, adding much to the occasion. Mr. Gerrish has been very active in bringing about this meeting, and deserves great credit for his success. In the afternoon the meeting was taken in hand by the farmers, and was fruitful in discussion.

The town of Webster is purely agricultural in its interests, and its inhabitants scattered like any farming town. There is no village of any size, and some of the farmers were obliged to travel four or five miles in the rain to attend. This town was formerly a part of Boscawen, having been divided some twenty years ago. The division was opposed by a good many of the people of the present town of Webster; and, as a citizen of the town remarked, they were recompensed by being allowed to take the name of the great American statesman. A farmers' club was started here several years ago, but did not flourish, owing probably to the distance which many had to travel to the place of the meeting. An attempt was made to start a grange here, but it did not ripen into any organization. The town is the possession of good farmers, and no better meetings have been held by the Board of Agriculture than those held here.

The afternoon meeting was called to order by Chairman Humphrey, at about two o'clock. He referred to the object of the Board in holding these meetings, and said that they were more to provoke discussion than give instruction. He spoke for a few moments on the corn question, and introduced Mr. Joseph B. Walker, of Concord, who took for his text the grass question.

The great question was how to get hay. The general complaint among farmers was that they were not making enough out of their farming operations. The business paid well enough as far as it went, but there was not enough of it. To increase the extent of our agricultural operations, we must increase our hay-crop. It is at the bottom of all successful farming. We must plow our grass-land oftener. It needs to be turned over as often as once in five years.

The question that first arises is, *when* would you plow? I plow at all seasons. Have laid down about twenty acres this

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summer. The best time, however, to sow grass-seed, is in the month of August. In the latter part of the summer season when you have all your men employed, you have more or less lowery weather in which your men cannot put in full time. This will be the best time for you to break up your land. My practice is to plow eight and one-half inches deep. My land is on the interval of the Merrimack River. Land is flowed, and becomes packed down hard. Aside from this, I am troubled with witch-grass, so that the sward is very tough. I use the Oliver chilled plow as a breaking-up plow. It was invented in Indiana to meet the wants of a prairie soil, and will not work well where land is very rocky, but can be operated on an average soil.

After plowing, put on a harrow and pulverize the soil thoroughly. Spread on five cords of good stable manure to the acre, or its equivalent. Plow it in, with a small plow, from four to five inches deep; and plow the same way as before, and not across the furrows. By this means the manure is buried all the way from one to five inches deep, and is thoroughly diffused through the soil.

Now the question arises, *what* shall we sow for grass-seed? I raise hay for the Concord market, and it must be free from clover. I therefore seed with one-half bushel of herd's-grass to the acre. This is supposed to be done by the twentieth of August. Roll it in after a day or two. By October the grass has grown to six inches in height. When grass reaches this point it is safe and will not winter-kill. I roll it in because I do not wish to bury the seed beyond resurrection. Experience shows that the grass-seed which is buried the slightest comes up and thrives the best. One season I did not roll it in at all, owing to the sudden frost, and supposed it was a clean loss. What was my surprise the next spring to find it growing well. Clover should be sown very late in the fall.

Manure for grass, and I am talking of grass rotation, should be what the crop takes from the soil. One ton of mixed hay takes from the soil: Potash, twenty-six and one-half pounds; lime, seventeen and two-tenths pounds; magnesia, six and six-tenths pounds; phosphoric acid, eight and two-tenths pounds;

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sulphuric acid, four and eight-tenths pounds; nitrogen, thirty-one pounds. These are the main ingredients. These must be supplied unless they are very abundant in the soil. Now where shall we get these, and get them most economically? Let us look at stable manure. One cord of good stable manure contains: Potash, thirty-eight pounds; lime, forty-two pounds; magnesia, eleven pounds; phosphoric acid, fifteen and one-half pounds; sulphuric acid, nine and six-tenths pounds; nitrogen, thirty pounds.

By these tables you will see that a cord of good stable manure will produce one and one-half tons of good hay. Now, if you would double your hay-crop you must double your manure-pile. The manure-pile must be on your mind from one year's end to the other. If you will do this, you will double all your crops. Stable manure is not the only manure that can be used. In some parts of the State ashes are used to advantage. Some farmers maintain that two hundred bushels of leached ashes are equal to seven or eight cords of stable manure. The character of the soil has a good deal to do with the profit of ashes. Mr. Simeon Abbott, of West Concord, has a compost of the following ingredients: Two bushels of lime, four bushels of salt (to be made into brine), one hundred and fifty pounds of plaster, making in all about twenty-five bushels of the mixture. This, he claims, is good for an acre for two years. I have used a good deal of spent lime that is taken from the tan vats of the tannery at Concord. Pulverized it and plowed some in, and used some as top-dressing. The results were all out of proportion to my expectation. The special fertilizers contain the ingredients that you need for your grass-crop; but I think we can do better to make our own manure.

Mr. Humphrey advocated the use of the Randall harrow, as a remedy for some of the ills of agriculture. Rocks, to his mind, were no impediment to its successful use; it seemed to instinctively lift itself over them, scratch the dirt about them, hunt around after the balky places, and when the piece was harrowed it reminded one of a spaded garden. This is not Mr. Humphrey's speech, though suggested by his graphic description of the working of the implement.

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Mr. Barnard of Hopkinton followed Mr. Humphrey. He believed the most profitable way in farming was in getting the land into grass. Used a plow similar to the one used by Mr. Walker. Could lay the land down better by seeding immediately than after a year's hoeing. Plowed eight inches deep, and harrowed well. Could harrow his land well enough with a common harrow. Some of his land does not need turning as often as once in five years. Had to plow interval about as often as that; but the fifth crop on some upland is one of the best hay crops. Believed with Mr. Walker that we should make our own manure. Irrigated a good deal. We should use every drop of water in every brook that passes through our land. It is the cheapest and best manure we have. Advocated the saving of the wastes about the barn, and contrasted the amount of manure made where the barn was suitably arranged and where it was not. If half the money that was expended in special fertilizers was paid out in getting absorbents for what runs off in the liquid form, we should get a larger return from our farms.

Mr. Humphrey said he was against deep plowing. He put his manure right upon the grass-land after haying, and plowed it in about four inches deep. Had used Stockbridge fertilizer on grass-land. Plowed up an acre five or six years ago, and manured it with Stockbridge fertilizer. It cost seventeen dollars. Plowed another acre and manured it with stable manure at thirty-five dollars an acre, and this last summer should like to have any one tell which was the best. Have taken a ton and a half of hay from an acre by the use of chemical fertilizers.

Mr. Fisk of Webster said he should have to begin where Mr. Humphrey left off. Had been too poor to raise corn. Couldn't wait for it. Had therefore discarded it. Haven't raised since we came to our farm one hundred bushels of corn. Made a departure last year, and we find ourselves still too poor to raise it. We are too far from the market to buy fertilizers to raise it. Was surprised to hear Mr. Humphrey denounce sending money out of the State to buy corn, and yet advocate sending money to buy fertilizers. Our soil is not worn out; it is over-

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worked. It needs manure. Cannot afford to buy corn fertilizers, and so buy corn to feed out and make manure. If we get pay from feeding the corn in the growth of our stock, and have the manure left, what better can we ask? We have wanted hay. Sometimes we can buy cheaply and sometimes not at all. We can only purchase our neighbors' surplus. We want a substitute for hay. Corn will not answer. Commenced thirteen years ago to raise corn-fodder as a substitute. It was a new thing at that time in the neighborhood. Put in two acres the first year. Had more than we needed as a green fodder and commenced to cure it. Tried several ways, but it seemed impossible to prevent the leaves and stalks from blackening. When we fed it out, however, the cattle ate it readily. Since then have raised it as a forage crop. In this way have been enabled to buy cattle in short-hay years of our neighbors who were obliged to sell. Have grown it as a second crop after hay, turning over the sod the last of June and July and manuring. It has not always been a successful crop, owing to droughts. This year some of it grew only two feet high; but the ground had been plowed, and that is worth something.

Mr. James L. Gerrish spoke of fodder-corn. Said he had measured Mr. Fisk's land. It was warm, not strong, and bore a crop of witch and June grass. It was manured broadcast and in the drill. Had no difficulty in raising corn seven feet high, of the Southern white variety. It would weigh three or four tons to the acre.

Mr. Fisk said he had paid for corn as high as two dollars, and as low as fifty cents. Seventy-five cents was about the average price.

Mr. Walker inquired of Mr. Fisk how much he gained by buying and drawing corn at that average over what he would have gained by raising his own corn. Thought that Mr. Fisk could raise corn as cheaply as Mr. Humphrey could, and the latter raised it for forty cents a bushel.

Mr. Fisk said, what do we want of a crop of corn anyway? What we use on our tables is very little. We must have money. Can't we get money as easily, as quickly, and as surely by raising something else? Corn goes well with hay, but is not an equiva-

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lent for it. Cannot use it with straw and bog hay, and make it a substitute for good hay. Want something that comes quickly and that can be turned quickly. While our neighbors are waiting to turn their crops we have got the money for ours.

Mr. Sawyer spoke for a few minutes on the corn question. He thought that corn-fodder should not be dried too much, as cattle would not eat it. Put his into a bay and mowed it down. He directed attention to the contrast in some of the corn he had brought for exhibition and that planted by Mr. Humphrey and others.

In the evening, the Chairman opened with a short lecture on fancy farming. He urged the encouragement of it, on the ground that fancy farmers are usually men of means, who spend their money without regard to returns. No man is so beneficial to a community as he who comes into it and builds up his town by improvements on and about his buildings. They ought not to be sneered at.

Mr. Walker followed with a lecture on English agriculture. It was interesting, like all his talks, and was the result of observations of his travels in England. The following table, compiled by him from a recent article in the "Princeton Review," will be interesting as showing the tenure of the land and the reason for the emigration of English farmers to America: —

NUMBER OF SEVERAL GRADES OF ENGLISH NOBILITY, AND NUMBER, ACREAGE, AND ANNUAL VALUE OF THEIR ESTATES.

		Separate landed estates.	Acres.	Estimated rental.
Dukes	28	158	3,991,811	£2,357,655
Marquises	33	121	1,567,227	1,383,671
Earls	194	634	5,862,118	5,007,119
Viscounts	52	120	796,849	644,791
Barons	218	560	3,085,160	3,135,852
Total	525	1,593	15,303,165	£12,529,088

AVERAGE NUMBER OF ACRES HELD BY EACH ONE OF THE NOBILITY.

Average number of acres held by dukes	142,564
" " " " marquises	4,741
" " " " earls	30,217
" " " " viscounts	15,324
" " " " barons	14,152

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New Hampshire has an area of 5,939,200 acres and a population (1870) of 318,300, or about 12 1-3 acres to a person while England has a land supply of only 1 17-18 acres to a person.

THE OWNERS OF ONE THOUSAND ACRES AND UPWARDS IN ENGLAND.

	Owners.	Total extent in acres.
England and Wales	5,408	18,695,528
Scotland	1,758	17,584,828
Ireland	3,745	15,802,739
Total		52,083,095

The area of Great Britain, exclusive of the metropolis of London, is 72,147,766 acres. The landed gentry, about 7,000 in number, are in possession of about four-fifths of the United Kingdom, or 52,000,000 acres. Land is entailed, and but very little is owned by anybody.

Mr. Adams, the Secretary of the Board, was then introduced, and spoke of plant-food, the substance of whose remarks have been given in former reports.

He was followed by Mr. Walker, who contrasted the condition of the Irish cotters and their manner of dairying with that of the nobility of England. As the night was rainy, the meeting closed after his remarks, with thanks to the people on the part of the Board for their attendance, and from the people to the Board for their visit.

Some of the citizens of Webster did all that they could to make the meeting a success. There can be no question that it was beneficial; and I have only to suggest, in closing, that the farmers of Webster organize a farmers' club, and hold their meetings in different sections of the town alternately. Let them meet in every school-district as often as once a fortnight, and discuss questions of interest to their locality. In this way a farmers' club would succeed. There is plenty of good material there to make it successful.

MEETINGS AT ANDOVER AND WILMOT.

From Webster the same gentlemen went to Andover and Wilmot and held meetings. They were not largely attended.

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At the former place Dr. Mason was present and read an interesting paper on "Diseases of Domestic Animals," speaking especially on pleuro-pneumonia, splenic fever, and some of the more common ailments of our live stock. He condemned the quackery which is very common in our State, and was equally severe in reproof of those physicians who consider it beneath their dignity to lend a helping hand in case of disease among cattle. He advocated the more general practice of veterinary science by men who have been educated for that purpose, and advised farmers to reject all advice from mere quacks, such as are found in every town, claiming to know how to treat diseases when they have not the least knowledge of the anatomy or physiology of man or beast. Better far let nature take its course than suffer from such ignorance. When an intelligent veterinarian is at command, let him be called early in case of disease among animals. In his absence, call a regular physician, who, in most cases, will give attention to the case.

In cases of acute disease arising from overeating or excessive work, if the animal is in pain, and no medical aid can be had, it is safe and advisable to give laudanum in heavy doses. The animal will bear a large quantity compared with human beings.

At this meeting, and also at Wilmot, Mr. Adams talked "Manures," — animal, first; chemical as an aid and as a substitute. He had with him several vials of potash in different forms, also soda, magnesia, ammonia, bone-black, etc., which he exhibited and explained, designating what is needed for rocky soil and what for loam, muck, sand, etc. Mr. Adams also showed how the plant germinates, gathers up its food, selecting and appropriating according to its nature.

Mr. Walker discussed the grass question, making a leading point to grow not less than one ton to the acre. Ground needs stirring according to circumstances. His remarks were in substance given in the report of the Webster meeting.

Mr. Walker made the evening sessions interesting by relating reminiscences of his journeyings among the English, German, and Italian farmers.

Mr. Humphrey talked "Corn," advocating, as is his custom, growing corn on the light lands, keeping the more moist and heavy

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sections in grass; this would make both more profitable. He plants with machine, uses both stable manure and chemicals, cultivates, hoes but little, cuts up and shocks in the field, and gets an average of over sixty bushels per acre at a cost not exceeding forty cents per bushel.

The evening sessions were well attended, and some of the afternoon meetings called out very fair audiences.

Generally the farmers took an interest in the discussions, relating their own experiences, asking questions, and expressing much satisfaction with the manner in which topics were presented.

The Wilmot people were very hospitable, and seemed disappointed at so limited an attendance. It was subsequently learned that farmers did not attend because they fancied they had no right, not generally belonging to the farmers' club.

MEETING AT KEENE.

It was arranged to unite the three contemplated meetings in Cheshire County in one to be held at Keene, and plans were laid for first-class speakers and a large and enthusiastic meeting; but the first real snow-storm of the season occurring on the day assigned, Nov. 18, much disappointment was experienced. A good meeting, well attended, was, however, held. Mr. Sanborn gives the following report of it in the "Mirror and Farmer."

The following members of the Board have conducted three sessions at Keene to-day, under the direction of the county member, Mr. Harvey: Messrs. Adams, DeMeritte, and Parker. From abroad the party were aided by Prof. Stockbridge of Amherst, Mass. It was the purpose of Mr. Harvey to hold only one meeting for Cheshire County instead of the usual three allotted a larger county, intending to make this meeting of sufficient interest to call out the representative farmers of the county. The storm, which continued all day, interfered with the attendance very materially, yet a good average audience greeted the speakers. I shall confine my notes principally to the remarks of Prof. Stockbridge, expecting to report the addresses of members of the Board as they may occur elsewhere.

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The forenoon session was devoted to "Farm Machinery." The subject was opened by Mr. Sanborn by a written lecture, which is printed in this volume. In the discussion that followed but little was added to the matter of the paper. An objection to Kemp's manure-spreader was made, which was that on side-hills it would not spread well, the manure working to the lower side of the cart. The Secretary, Mr. Adams, mentioned the result of a trial of a dynamometer applied to the Doe and to the Oliver chilled plows on the farm of Joseph B. Walker, Esq., of Concord, from which it would appear that the Oliver chilled drew much easier than the Doe plow. The machine is a recent purchase of the Board for such purposes, hoping that some good may be accomplished in determining the draft of plows, mowing-machines, etc.

The afternoon session was devoted to an address by Prof. Stockbridge, and to a discussion of his subject, "The Fertilizing Effects of Tillage."

In reporting this talk of Prof. Stockbridge I shall not attempt to report in full his exact language, but shall be at some care to give expression to his sentiments. Commencing, he said that the great problem before the farmers was the restoration of the old farms, so that they would produce paying crops, and at the same time make it pay as the process of improvement went on. Many have settled down to the conclusion that the problem is insolvable, and in that belief take to emigration.

This emigration from New England might be a good thing for the West, and for the East a bad thing. He was satisfied that it was a bad thing for the emigrant, and thought he would do best on the old farm. Our farms may be made fertile again. Some never were fertile. Really what ails sterile soil of New England? As wise builders we should find what ails our soil. A man owning a sick horse, previously sound and well, when taken sick does not abandon him, but proceeds to doctor him. We should find out what ails our soils and doctor them.

What has happened to the soil between the two periods of fertility? The tilling of it has not hurt it; the crops taken from it have extracted its fertility. What have these crops taken? Ninety-five per cent of our crops come from the air and five per

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cent from the soil. The plant-feeding organs are its roots and leaves. The leaves gather food only in the form of gas; thus its starch, sugar, gum, and oils are gathered. The real feeding roots are the fine hair-like threads that penetrate all through the mass of soil. They do not feed on soil, but absorb their food in a state of solution in water; thus they obtain their potash, silica, lime, magnesia, phosphorus, sulphuric acid, alumina, and chlorine.

Comparatively speaking, only a few soils are sterile, for soils contain enough of the materials named to grow crops for generations, but the soluble materials are depleted. Natural agencies are constantly at work making soluble material out of insoluble soil. Some soils develop soluble matters faster than others. Few soils develop plant-food as fast as crops need it, and thus the soil becomes depleted of material available to the plant. How can we hurry up the development of plant-food in the soil? We will take all known methods. One method is to give it rest; another is to plow in green crops; another is rotation of crops, manuring, chemicals, the use of chemicals as solvents, and tillage. Tillage will be my subject. Much of the materials that answer for plant-food exist in silicate form in the soil, or insoluble form. The soil is broken down by natural agencies. The air is the main force. Air is made up of carbonic acid, nitric acid, oxygen, and other materials that are chemical agents acting on the soil. Some soils that are plowed up under adverse conditions farmers term dead and lifeless soil. In those soils there has been a lack of chemical action. Oxygen is the great decomposing agent of nature. All the monuments of man will, in time, crumble under its corroding action. Entering the soil it oxidizes organic matter, preparing it for food for plants. It also acts on the inorganic materials of the soil; converts phosphorus into phosphoric acid. Uniting with carbon we have carbonic acid, and this acid seeks a base with which to unite. It finds lime united with silica, and itself uniting with the lime produces carbonate of lime. These and other changes are constantly going on, insoluble soil being converted into soluble plant-food. Constant tillage aids these processes of natural forces. There is a constant tendency to form insoluble

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compounds in the soil. Adhesion and cohesion, compacting by rains and other causes, are constantly hardening the soil. The soil must be kept open by tilling that the particles of soil may be open to the action of the agencies that oppose these tendencies.

Prof. Stockbridge named some of the agencies to be considered, as movement of water in the soil, temperature, manures affected by tillage, pulverizing with plow and harrow.

However rich in plant-food a soil may be, without water it will be sterile, for all soil-food enters the plant by water. Stagnant water is dead water. Water is constantly passing off with the air. The movement of water in the soil is on a gigantic scale. In summer it penetrates the soil only two or three feet. Between May 1 and Nov. 1 there fell, per acre of ground, at Amherst, 18,919 barrels of water; of this, 16,169 barrels evaporated into the air, and 2,750 barrels went down into the lysimeter. This does not correctly state the case, for water rises from ten feet deep, whereas over the lysimeter there are only three feet of soil to evaporate water, nothing evaporating from the water caught by the lysimeter. This water moving up and down in the soil is the wagon that carries food to the plant-roots. The water in its movements does not carry off phosphoric acid or potash. Can we conserve the water of the soil? If so we ought to know how and do it, for it is of the utmost importance. Till it; but in tilling will you compact it? In tilling make it light as possible. More water can be saved by implements and horse in one day than could be spread on by a horse with a water-cart. The water rises in the soil in capillary tubes. When the particles of soil are near together it rises fast; when separated by greater spaces it rises slower. Tillage separates them. By tillage 100 barrels per acre of water per day have been saved. Lawes shows an acre of corn to evaporate 1,570,000 pounds of water in a season.

Tillage affects temperature. Soils hold heat and conduct according to density. Sandy soils conduct quickly; heat fast and cool fast by night. Separate particles never become so hot. Cultivated soils are not so warm by day by five to ten degrees, and do not cool off so fast by night; thus the temperature of the entire day and night is better equalized.

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We cannot afford to pay a dollar for seed or manure until the soil is well tilled. Thorough tillage is a part of my gospel. If I wanted to get an old dollar for a new one, I would join tillage to manuring; would fertilize for soil rather than crop, for land is cheaper than manure. Fertilizers are chemical agents, acting readily on the surface of particles, but not on masses; therefore the manure wants to have a perfect mixture with the soil. The addition of sulphate of lime to a soil will give four times as much matter to the plant as the application supplies. It will also furnish to the other materials. Tillage is fertility, and fertility is value. Till, and have system in tilling.

In plowing, plow in the fall, for the disintegrating action of the frost. Frost is one of nature's mighty, potent forces. We want to plow tenacious soils in the fall to get the fullest action of this force. In plowing stubble-land, plow two furrows back together. Below these furrows the frost reaches five feet deep, when on sod-land near it it freezes only two feet deep. On tenacious sod-land would lap the furrows, thus giving an air-chamber under the furrow for the free action of frosts. On light lands would plow in the spring. The depth to which he would plow would depend entirely upon the character of the land, and the depth to which it had been previously plowed. He would plow below the agricultural soil but slightly, and if not deep enough would deepen an inch a year, not wishing to turn up the dead and lifeless soil in large quantities at once. The agricultural soil of which he speaks, is a mixture of organic and inorganic materials in proper portions for plant-growth, and fitted for the purpose by atmospheric agencies. This soil is sometimes not more than two inches deep.

A Georgia man, the commissioner of agriculture for that State, had asked him what fertilizers he would advise for their soils, describing them, and adding that they are plowed with one mule and a wooden plow, two inches deep. He advised not to think of buying fertilizers so long as they plowed two inches deep. You have no money, he said, for fertilizers, but want Yankee plows; and when they had gradually worked their soil down to a depth of agricultural soil, then it would do to think of buying fertilizers or of using their cotton-seed meal.

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The speaker closed with a brief discussion of the farmers' situation, taking a very hopeful view of the future.

This talk was discussed at some length by Mr. Whittaker of Massachusetts and farmers of the place, including members of the Board.

The first topic of discussion in the evening was "Sugar-Beet Culture," by Mr. DeMeritte of the Board. The speaker impressed upon all the importance of the industry to the country. Having shown the matter to be of national importance, he then proceeded to show it to be of individual importance, for he believed that the price paid, five dollars per ton, was one at which they could be profitably raised. In their production thorough preparation of the soil was essential. Would plow deep, manure highly, and grow the beet as much in the soil as convenient, for thus grown they carry more sugar than when grown out of the soil largely. The Germans feed the pulp with straw and one and one-half pounds of oil-cake daily. On this feed cows give about as much milk as on grass. The speaker had a car-load that he was feeding with straw and cotton-seed meal. He then gave a detailed account of the method of sugar-manufacturing. Mr. DeMeritte then spoke of the probable success of the industry in our State, and advised farmers to get seed and experiment in its culture, and thus be preparing for extended culture, if the industry spreads into this State, as he believed it was now likely to do. So far as the profit of manufacturing was concerned, it was well understood that the Maine Company were doing a satisfactory business, in fact a very profitable one. They were now attempting to buy beets in Massachusetts, near Amherst, to carry to Portland. Twenty tons he considered a fair crop. A crop of fifty-six tons had been reported by a farmer in Maine. He did not know how authentic the account was. Following the lecture many questions were asked, but mostly covering ground already gone over.

Mr. Parker of Lempster was to follow with a paper on the "Position of the Farmer," but, as little time remained, he devoted a few minutes to the discussion of maple-sugar making in a practical talk.

Secretary Adams occupied the few moments remaining in

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words of encouragement, the speaker believing that the outlook was auspicious for farmers, in view of which he advised them to avail themselves of all modern means of swelling their returns.

MEETING AT LANGDON.

Messrs. Parker, DeMeritte, and Adams held a lively and well-attended meeting Nov. 19. There was a large attendance, a fine show of corn and grain, and a ready acceptance of the matter presented. Mr. DeMeritte repeated his sugar-beet talk, and also discussed grass-growing; Mr. Parker gave his paper on the "Farmers' Position," printed in the future pages of this volume; and Mr. Adams discussed manures, and the way plants grow. We put down the Langdon meeting as one of the best of the season, for which Col. Elwell, Dr. Lufkin, and a few others are to be thanked.

MEETING AT CORNISH FLAT.

On the 20th of November, Messrs. Parker, Sanborn, and Adams held a meeting at Cornish. A violent storm prevailed, and consequently the attendance was small. Mr. Sanborn gave his lecture on "Farm Machinery," Mr. Parker presented miscellaneous matters, and the Secretary discussed manures. As these are old and reported talks we need only name them now.

MEETINGS AT CENTER HARBOR AND SANDWICH.

On the second and third days of December the Board held meetings at the places above named, and were cordially greeted by the people. Messrs. Mason, Sanborn, and Adams only of the Board were present.

The opening session at Center Harbor was not largely attended, but the numbers increased until the Board had a good audience. The chairman, or president, of the local farmers' club, Mr. Sturtevant, was invited to preside over the meeting.

Mr. Sanborn, the county member, made a few opening remarks. Reviewing briefly the changes that have occurred in farming since the meeting last held at this place, years ago, Mr. Sanborn believed that the future promised more for New England agriculture than the past had witnessed. Tennyson had

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said, "Better fifty years of Europe than a cycle of Cathay!" He should prefer the thirty coming years of New England agriculture to the sixty years that preceded the war. Experimental work was shedding practical light on methods in agriculture. Experimental research promises to be more active in this country than in any other section of the world, and more to the point. He had noticed more critical observation on the part of farmers than formerly prevailed, and a readiness to profit by the experience of others, joined with an aptness to discriminate between the true and false, and apply to his own circumstances general truths or facts true only under given conditions.

The hard times and low prices of the past four years had not been an unalloyed evil. Dickens had said that "evil stops at itself and dies with the doer of it, but good never." While he would not care to indorse the moral, yet he believed that the good, or the attendant, of the low prices and low net profits of agriculture overbalanced the immediate disappointments. Our farmers had been stimulated, and everywhere there had been developed a determination to meet low prices by cheap production; and, as a result, better methods of stock-raising and of crop-production are in vogue, and still in a hopeful process of development. Particularly were better, cheaper, and more thorough methods of tillage being availed of. Present prices of most farm products were sufficient, under our gathered means for cheapening production, to enable the industry to be prosecuted with a success not heretofore attained, except under the abnormal state of things attending our late civil war.

"Veterinary Science," in its application, was discussed in a practical talk by Dr. Mason. The speaker had but little patience with those physicians who esteem their profession or themselves above bestowing attention upon the animal kingdom. Man is an animal, said the speaker, and only endowed with the same number of senses as the lower animals, and those frequently not so acutely developed in man as in many animals. Many illustrations were given by the speaker to sustain this view. He considered it a duty, and certainly it was a pleasure to him, to relieve pain in animals whenever he could. For this purpose he used laudanum, recommending one and one-half to

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two ounces for a horse. The doctor gave some instances of the successful use of this material for the horse in cases of severe pain. He had relieved and cured a horse after barbarous yet amusing treatment by common farriers. A peddler's horse had been taken ill with pain. As he passed, he found two stout men, one on each side of the horse, striking the stomach of the horse with their full strength with their fists. This practice, after heroic efforts, failed; and returning from his ride he found a boy riding the horse in great hurry up and down hill, and to the doctor's question as to what he was doing it for, he gave the same reply that the men did, "To get the wind out." Finally his advice was asked and taken. Laudanum being given, the horse soon was at his work. The loss of cud in oxen and the fallacy of making one, as he had seen done, to restore it, was considered. The fallacy of the whole notion was shown, and advice given to get a book on practical anatomy. A case of facial palsy was considered, caused by the rapping of the yoke against the jaws; cured by the use of a blister. Many instances of death of cattle by eating half-dried leaves of black cherry-trees were given. The dried leaves were not poisonous; a poisonous acid was formed in the partial decomposition of the leaves. The cutting of the trees and removing them from our pastures were advised. A gentleman in the audience said that a neighbor of his cut two cherry-trees, small ones, in the spring, and threw them from his field over the wall into his neighbor's pasture. Two cows died from eating the drying leaves. He, the speaker, had a case of lead-poisoning of a cow, from licking the paint from a newly-painted house. Before he discovered the cause the cow was too far gone for treatment. In case of colic, the speaker warned them against adopting the common practice of giving oil. It only aggravates the evil. For poison of sheep from eating lambkill, some one in the audience said they had never failed of a cure by using two glasses of raw rum.

The audience desired a discussion of the beet-sugar industry, showing an interest in this coming department of farm-husbandry by the free questioning of the speaker, J. O. Adams. Mr. Adams spoke of the success of this industry in Europe, and

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of the great need of a home source for the sugar consumed in this country. After recounting briefly the inauguration of the industry in Maine, he proceeded to give the details necessary to success. Ample use of old manure or chemicals, thorough tillage, good seed, and clean culture by the use of labor-saving machines, were the main elements stated to be necessary to success. The speaker was emphatic in his recommendation for thorough preparation of the soil for a crop of this character. With the indifferent fitting of ground for crops that prevails, the speaker thought the importance of the mechanical fit of the soil for the sugar-beet was under-estimated. Pursuing the loose system of cultivation in vogue, many Maine farmers had been disappointed in their results. Many had made their rows near together in such a way as to require all hand-weeding, and they were disappointed. For the Board of Agriculture he had put out three hundred pounds of seed among the farmers around Concord, and on the whole the reports that had come to him were favorable. Considering the subject in its relation to the farm profits, to the fertility of the farm itself when the pulp is fed from the roots raised as is done in Germany, Mr. Adams considered the business from the farmers' stand-point as promising. There had been, he said, some consultations in relation to the organization of a beet-sugar manufactory at Concord.

"How to Renovate our Farms, or how to Make our Farms Fertile, and Profitable while Making Fertile," was the first subject considered in the evening, Mr. Sanborn being the speaker. He considered profitable farming in New England as a certainty of the future. Radical innovations would have to be made in the system, or want of system, at present pursued, but he felt sure that proved facts enough existed to warrant, — more, to demand, broad changes in our methods as farmers. In fact, our farming is undergoing a change, imperceptible to the careless observer, but rapid when measured by the historic tardiness with which agriculture adjusts itself to changed circumstances. Our present tillage area would and should, in due time, be multiplied by three, and be amply fertilized by manure from purchased foods and chemicals, backed by a far better system of tillage operations, carried on by an abundant and varied use of labor-

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saving implements, used on land fitted especially for machinery. Our wasteful practice of feeding would be supplanted by system, based upon the purpose served by foods in animal economy as ascertained by experimental data. Rotation of crops and free use of capital would be important factors in the farming to come. To show that his scheme was not entirely visionary, he fortified each position taken by the results of experiments as superintendent of the state farm, and by the laborious results of practical, painstaking experimenters, and finally showing, by examples of various practical tillers, that in the field there is economy in the methods named.

"Curious and Instructive Facts in the Animal and Vegetable Kingdoms" was the next subject brought before the audience. As a good audience with many ladies were present, Mr. Adams sacrificed another subject proposed, for a subject better adapted to a mixed audience. In the field and flower and kitchen gardens many interesting occurrences and laws were referred to. Taking a kernel of wheat, its construction and the part in its economy each factor played were named, as far as known. Then its development, step by step, was followed to the mature crop.

At the conclusion of the Secretary's remarks a vote of thanks was tendered the Board, and then the meeting adjourned.

The members of the Board stopping in town for the night were hospitably entertained by Mr. Coe, where they found the refinements of city life in a country home. So rarely neat were the house, cellars, and farm-buildings that they deserve notice. Mr. Coe has a fancy for nice steers, and the skill to raise them. In his barn I found a pair of dark red steers, one year old, weighing eighteen hundred pounds. Your reporter has had occasion to price cattle in a more fertile section of the State, and has seen abundance of steers at from thirty-five to forty-five dollars per pair for two-years-old steers. Mr. Coe had been riding for steers, and in reply to my questions named very many steers at from sixty to one hundred dollars per pair. The difference is the difference between skillful and unskillful stock-management; between profitable and unprofitable stock-feeding. While price is not a good measure of the merits of beasts always, and in this extremes are given, yet I find a wide differ-

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ence in the stock of this section, including Meredith, and the one named. The secret of it is, a few men have introduced here good bulls, and their products have drawn attention to care in breeding.

We were taken from Mr. Coe's to the stock farm of Mrs. Sutton, a wealthy lady, who spends most of the year on the farm, stopping in Massachusetts in the winter. For pleasure rather than profit, a free use of capital has been made on her farm, yet it was not less attractive for that. In contrast with the surrounding bowlder-laden pastures and fields, its smooth and fresh fields were more inviting. One of these fields was reported to furnish five tons of hay per acre. By its judicious use with a moderate quantity of concentrated food, as fine a lot of Durham cattle was shown as it rarely falls to one's lot to see. In candor I must say, that, so far as food is concerned, a vast multitude of farmers of this State would show a much more unprofitable use of it. These steers and cows were the product of good breeding and right feeding, and teach us an honest lesson; and it does not become us or our interest to fortify our practices that return pigmies by stubbornly persisting in getting in the glare of the gold around those noble Durhams so that we see not the real elements of their production.

A noble flock of pure Cotswold sheep was noted, shearing, as I remember, ten and one-half pounds of combing wool; feed, good hay and one-half pound of cotton-seed meal daily, with added roots. The number I do not remember, but it is considerable over one hundred, arranged in parallel pens containing from twenty to twenty-five sheep. These sheep were in the care of a former English shepherd, Mr. Grantham. A steam-power does the farm-grinding, root-pulping, and hay and straw cutting. The buildings, of course, were substantial and nice and neat, presenting no new feature not common to modern farmers with new barns, except one that now occurs to me, — the cellar bottom was concreted and made water-tight. I have seen this in a few other cellars, and, after considering the cost, express it as my opinion that it is the cheapest method of saving urine, and far preferable to the too common method of drawing in and out and spreading the dirt that it requires to

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accomplish the purpose sought. Think of it, farmers. I believe it is better than twenty per cent even in stocks. For one who is using money for pleasure in farming, Mrs. Sutton has shown certainly good and unusual sense in its outlay.

From Center Harbor to Sandwich the fields are rock-scattered. In few sections are so many large bowlders seen in the fields; this is along the main line of travel. To the right and left of us could be seen well-cleared fields. Obviously, the fields along the main line of travel presented a rocky front too formidable for even the classic industry of a New Hampshire farmer. Their sons will put to rout this foe that stands right in the way to success. Stopping to dine with Dr. Mason, we found corroboration of the old remark that professional men often make the best of farmers. It is rare in our State that so well laden a table is the fruit of home production, for the doctor's ever-cheerful wife is not second to the doctor in her enthusiasm and native love of farming; thus it was that nearly all of the products of mixed farming were to be found at the home of the member for Carroll County, the busy bee not excepted. We were shown two fields that he had cleared of bowlders, and the contrast between them and surrounding pastures and neighboring fields, which we were assured were no worse than the fields cleared, was calculated to leave the impression that here was pluck superior to discretion; but we were assured that it was a profitable operation, and that one field gave five tons of hay as its first product, after sinking and removing rocks. Sincerely, I have seen but few fields in our State where bowlders prevail so freely as in this section, yet the doctor demonstrates that to clear these fields, as he says, is much less than would be supposed, and profitable. This is important, because the inevitable will force our hill-farmers to clear their fields out, or to clear out.

Both sessions at Sandwich were well attended and the audiences unusually attentive to the speakers. Dr. Mason presided, opening the meeting by a few remarks, making no set talk, as it was arranged that he, being near by, should give a lecture on some coming evening. He introduced Mr. Sanborn, who continued the subject taken at Center Harbor, more fully, dividing it into two parts, occupying an hour in the afternoon and an hour in the evening.

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He was followed by Secretary Adams, who talked on "Cattle-breeding." His paper appeared in full in Volume VIII. of these reports. It is but just to say that these lectures are repeated often when a fresh subject would be more agreeable to the speaker, the Board appearing to make it a point to consider those subjects called for; the almost universal call is for practical talks on a few of the leading departments of farming. Thus, "How to make Farming pay," "Breeding," "Feeding," and "Manuring," never grow old.

In the evening session, Mr. Sanborn gave an extended talk on implements, same as appears in this report in coming pages.

Mr. Sanborn was followed by Secretary Adams in the talk given at Center Harbor. Speaking without notes, these talks of Mr. Adams are somewhat varied by fresh illustrations or added matter. He had the close attention of the audience during his hour's talk.

By request, Mr. Sanborn gave an account of the Agricultural College, — its course of studies, cost of course, and opportunities for students to work on the farm. By the speaker's statement, it seems that unusual facilities are afforded for a nominal sum, and that nowhere in the State, not even in our academies, is so much acquired for the money expenditure.

Dr. Mason closed the meeting in a few remarks in application of the talks given by the lecturers.

MEETINGS AT DEERING AND LYNDEBOROUGH.

The meetings held at Deering and Lyndeborough, Dec. 18 and 19, were reported in the "Mirror and Farmer" by Mr. Hills, of the Board, as follows: —

Meetings of the Board of Agriculture were held at Deering Dec. 18, and at Lyndeborough Dec. 19, afternoon and evening. The weather was favorable and the attendance was good, — the ladies being well represented, and manifesting a hearty interest in the discussion. Mr. Goodell, the member from Hillsborough County, presided, and was assisted by Messrs. Adams and Hills. A quartet of singers added much to the interest of the meetings at Lyndeborough.

The topics discussed were similar at each place, but their

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treatment varied to suit the wishes of those present. Stock-raising, dairy-farming, and fruit-growing were considered by request, and Messrs. Adams and Goodell gave a talk on farm implements, and the necessity of using more machinery in order to compete with farmers at the West where machinery is extensively used.

Mr. Adams described many of the improved farm implements in use, such as the disc harrows, — the Randall and La Dow ; the steel and chilled plows, mowing-machines, hay-tedders, rakes, etc. He exhibited a dynamometer, owned by the State, used for the measuring force. Had tested the Doe plow by the side of the Oliver chilled plow, and nineteen observations show a difference in favor of the Oliver plow of three hundred and fifty pounds, the Oliver registering eight hundred pounds and the Doe eleven hundred and fifty pounds. There may be other plows requiring less power than the Oliver, and it is of the greatest importance that in purchasing farm implements we secure the best.

Mr. Goodell intimated that Mr. Adams had stolen a part of his thunder, but he gathered up fragments of electricity enough to make a little noise and excellent talk. We can give but a brief outline of his address. The speaker said that the object of all business was profit. What occupation shall a young man or young lady follow? Some are not adapted to farming; so of other pursuits. Success is attained by few ; it may be attained by many. It is useless to attempt to live the life of a Stewart or a Vanderbilt. We should not live merely for the accumulation of money. Be content with reasonable success. Few old men encourage their sons to become farmers, but rather discourage them by representing the occupation to be profitless drudgery. Such talk should cease. There is profit in tilling the soil, even the hard soil of New Hampshire. Our farms must be fitted for the use of machinery. A field that cannot be put in a condition to admit of the use of the mowing-machine, the horse-rake, and the tedder, should be turned out to pasture or to wood. If the entire farm is of this character, let it be sold or abandoned. No man can compete with the West on such a farm in growing crops for the market.

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The time for farmers' wives to weave cloth in the attic on the hand-loom, and for knitting by hand, has passed. We can buy the manufactured goods almost as cheap as the raw material. The farmer who undertakes to put hand-labor against machinery will surely fail. But in purchasing machinery for the farm, do not forget that there are improved churns, butter-workers, washing-machines, and clothes-wringers, — he did not name apple-parers, — to lighten and expedite the labors of the wife and daughter.

The objection often raised when the use of farm machinery is recommended, is, "We can't afford it." The speaker said he could not afford to farm without machinery. He had used a tedder till he had worn it out. He would have a tedder if he had a mower, and he would have a mower if he had a farm.

Farmers must learn to be as shrewd as business men, must learn to buy and sell at the right time. He would not advise the holding of crops for a rise, but it is poor policy to crowd an overstocked market. He knew a man who sold his apples this year for one dollar per barrel, because he had not noted the signs of the times.

The speaker urged the farmers present to try to establish a reputation by doing everything a little better than his neighbor. Fruit properly picked will bring double prices, and the adoption of improved methods in the manufacture of butter and cheese will insure greatly increased profits and more ready sale.

Mr. Goodell thought he could make as large a percentage in farming as in any other business. A man in Jaffrey was referred to who had acquired one hundred and fifty thousand dollars entirely by farming. Of every one hundred men in trade, ninety-five fail, while in farming ninety per cent succeed.

Mr. Hills, by request, discussed fruits and fruit-trees, Mr. Adams gave a talk on improved husbandry, and Mr. Goodell one on grass-growing and hay-making.

Many inquiries were made and answered. The inquiry how to bring up exhausted soil and raise good crops out of nothing, remains open. Your reporter would suggest the use of *fiat manure*

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MEETING AT CHESTER.

The Board was represented at Chester, Jan. 7, by Messrs. Hills and Adams. The three sessions were well attended by an intelligent class of citizens of this splendid old farming town. The farmers of Chester can get up a good farmers' meeting at any time, without help from outside, and on this occasion contributed much to the success of the meeting.

They have two farmers' organizations in town, but there appeared to be no conflict between them. We were informed that Dr. Brown is president of one society and Dr. Chesley of the other, but they are not doctors who disagree so far as farming interests are concerned The interest taken by the people of Chester in the subject of agriculture was indicated by the presence, during the day and evening, of such men as Hon. T. J. Melvin, Hon. J. W. Noyes, Rev. Charles Tenney, Rev. Mr. Carter, Dea. William Tenney, Hon. Mr. Cochran, Capt. S. F. Learnard, Mr. Crawford, Mr. Wilcomb, Mr. Hook, and a score of others, most of whom participated freely in the discussions.

Dr. J. F. Brown presided, and opened the morning session with appropriate remarks. He said the business of the town was about equally divided between shoe-making, lumbering, and farming. Farmers were largely engaged in the sale of milk, butter, and fruit. About nineteen thousand barrels of apples have been grown in Chester the past year. The speaker said the question how they could compete with Massachusetts in the sale of milk was a matter of great interest to their people. It seemed impossible to compete in the making of milk for the Boston market at two and one-half cents per quart.

Mr. Adams followed, on the subject of "Dairy Farming." He claimed that the farms of Chester could produce an honest article of milk as cheaply as it could be raised in Massachusetts. The milkmen of Massachusetts might have more abundant and cheaper water, might understand how to manipulate their milk so as to put upon the market a cheaper article; but they had no advantage in pasture, hay, or any of the conditions required for the production of milk or butter of the very best quality at a fair price.

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The first thing that the dairy farmer should attend to is to secure a herd of cows adapted to the special branch of the business engaged in, whether for butter, cheese, or milk. Many of the cows in the State do not pay for their keeping. The profit that might be derived from the better part of the herd is consumed by inferior animals. This has been demonstrated by actual experiment. An ordinary cow will not yield over thirteen hundred quarts of milk in a year, which, at two and one-half cents, gives thirty-two dollars and fifty cents. It will cost from thirty-six to forty dollars to feed one of these cows, resulting in a loss to the owner. A cow that will give eighteen hundred quarts per year will yield a profit varying as the expense of keeping may vary. A cow giving sixteen hundred quarts will just about pay for keeping. Some herds will give an average annual yield of from two thousand to twenty-three hundred quarts, and such animals will pay a profit even at the present low price of milk. There are cows that have given three thousand quarts, but they are rare. Farmers are not all particular to know just what each animal yields. The milk of their cows is mingled so that they only know that the whole herd barely pays expenses. This ought not to be the case. Every animal should be tested. Weigh the product of each for a week, at least, at different seasons of the year, and carefully note the time of her going dry. If she does not pay a profit, turn her for beef at once. The farmers of some towns make money in the milk business owing to their favorable location, and in part to the good management. Bedford receives from the city of Manchester one hundred thousand dollars annually for milk, making it one of the best farming towns.

The speaker advised the dairymen to try butter if milk does not pay. For this purpose select cows that will give the greatest amount of butter. The Ayrshires are best for milk, but not for butter. The Devons and Durhams have good butter strains. The Alderneys, Jerseys, and Guernseys are good for butter, but do not yield large quantities of milk. The Guernseys have not been introduced much into New Hampshire. They are much like the Jerseys, only larger. We want a breed of cattle good for oxen, for beef, and for milk. For a single cross would take the Shorthorn and the Devon.

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The inquiry is often made: "Why not get up an American breed?" We could if we had the patience. The Yankee is too much in a hurry. The Shorthorn is the result of more than a hundred years of intelligent, careful breeding. The best thing we can do is to avail ourselves of what others have done. Select the best cows we can find and cross with a perfected bull. Repeat this process, and we improve our stock every time. The bull should be from a thorough-bred herd. Should prefer thorough-bred cows, but they cost too much.

In order to succeed, we must have a love for this business, keep our cattle better, have better barns, and feed better with a better quality and better variety of mixed food.

Rev. Mr. Carter inquired, "How can fodder be mixed so cattle will eat it clean?" Mr. Hook replied, "With a fork only."

Mr. Wilcomb feeds poor hay, butts, or straw in the morning, good hay or shorts at noon, and at night run hay and a few apples or roots. This brings the cattle out in good condition. He had made poor apples into cider and vinegar till his cellar was full, but could sell neither cider nor vinegar. He now commences early to feed his apples to his cows, about one peck each. They are worth ten cents a bushel to feed to stock. They increase the flow of milk, and give the animal an appetite. Mr. Hook has had experience in feeding apples. Cattle are very fond of them, and are benefited by them if carefully fed.

Hon. Mr. Cochran approved of what Mr. Adams had said about tight barns, though not half the farmers had water in their barn-yards; Mr. Wilcomb has no really poor hay on his farm.

Mr. Adams said experiments have shown that it will not pay to purchase apparatus for steaming food. It is a good way to cut the food, put it in a feed-box, sprinkle over with meal or feed, apply hot water, and shut it up tight. Dea. Tenney has practiced the process of steaming in a box, and finds that it increases the flow of milk and economizes poor food. Thinks shorts and meals mixed preferable to either alone, especially for young stock. A steer gained five inches in a winter on two quarts of shorts and meal per day.

Rev. Mr. Carter inquired the value of salt hay. It could be had at five dollars per ton in Hampton.

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Dea. Tenney said his father used to feed salt hay. Found it useful to feed with poor hay. The cattle would do well.

Mr. Hook thought the only advantage in feeding salt hay was that it induced the cattle to eat poor hay.

Mr. Jones inquired about fodder-corn. Mr. Adams said he thought corn-fodder excellent. Had not tested fodder-corn much. Thinks green fodder will produce irritation if fed in excess.

Mr. Jones had heard Dr. Loring say that fodder-corn would never produce a drop of milk or an ounce of butter, and he began to believe it.

Mr. Cochran knew that sweet fodder-corn was eaten greedily and was valuable.

Mr. Brown would plant fodder-corn in double rows, having a space between. Did not think Southern corn good; preferred Stowell's evergreen sweet-corn.

O. M. Tenney thought it depended upon how fodder-corn is raised. Sows sweet-corn three feet apart and cuts out every other row.

Capt. S. F. Learnard advocated warmer barns. Thought there was more profit in butter than in milk. But we must have the right kind of stock. He had the Durham and Jersey. Twelve quarts of the Jersey milk would make a pound of butter. Had known a cow that would only make a pound of butter from twenty-two quarts of milk. The cow is a machine; the better you feed, the more and better the butter, and the better the price obtained. He feeds two quarts of meal and two quarts of shorts. In answer to an inquiry he said he had not known a case of horn-ail since shorts had been fed; before it was quite common. He was an advocate of the corn-crop and corn-fodder. Binds the fodder in small bundles to cure, and cuts the fodder before feeding. Feeds grain at night. It will do twice as much good. He had found the Jerseys healthy and hardy.

The afternoon was occupied by Mr. Hills, whose subject was "Fruit-culture." His talk was followed by quite a lively and interesting discussion. Mr. Learnard said that he sent the first fruit to Boston in 1840. This year, though not the bearing

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year for apples, they had raised nineteen thousand barrels. They received more money from fruit in Chester than from all other crops sold. We should make it a point to establish a reputation in packing apples. He, with others, had been urging this upon fruit-growers till they had become satisfied of its great importance. Apples shipped from Chester to Boston, having the names of reliable growers on the casks, are now never inspected. Their names are taken as a guaranty of the quality. Mr. Learnard believed that peaches could be raised with profit in Chester, as formerly. Pears do not succeed quite as well as elsewhere. The bearing year of the Baldwin apple could be changed by cultivation.

Mr. Wilcomb had much experience in packing apples. He could tell the character of a man by his manner of packing apples. He could change the bearing year of the apple by plowing in the fall or spring. Could make a young orchard come into fruit the " off " year. He expected to have proved it this year, but found that other orchards fruited as well as his. Plowing cuts the small roots, and checks the growth, causing the tree to throw out fruit buds instead of making a wood growth. Mr. Wilcomb explained his theory at length, showing that he is a close observer.

Dea. Tenney said he liked to prune pretty high. Low branches will die off and must be cut away anyway. The fruit on low branches is shaded, destitute of color, and often mildews so as to be worthless.

Rev. Mr. Tenney said no subject was of more importance to the town than that of fruit. He had grown the peach successfully, and found that trees from his Early Crawfords came true from the pits.

The evening session was opened by an interesting address by Dr. Chesley, followed by a discussion of gardening by Mr. Hills and others. The meeting closed by complimentary remarks and a vote of thanks to the members of the Board, and all seemed to feel that the day had been both profitably and pleasantly spent.

The report of the meeting was prepared by Mr. Hills for the " Mirror and Farmer."

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MEETINGS AT NORTHWOOD AND BOW LAKE.

A meeting of the Board of Agriculture was held at Northwood on Jan. 9, by W. H. Hills, who presided, Moses Humphrey, and the Secretary, James O. Adams, of the Board, and a very desirable annex in the person of Joseph B. Walker of Concord. We appropriate the following report of this meeting by Mr. George R. Drake.

In the afternoon, Mr. Hills, in his opening and interesting remarks, urged the farmers present to take an active part in the exercises, and then introduced Mr. Humphrey, the Chairman of the Board, who spoke on the subject of "Raising Corn," and gave the following reasons as the most important why corn should be grown in this State: The crops in 1877 produced forty-two bushels per acre, a better average than was made by any other State in the Union. Last year, the season being unfavorable, the average yield per acre was reduced to thirty-nine bushels. The stalks (according to Prof. Collier) contain a large amount of sugar, and the speaker considered them worth one-half the price of good hay. By making an adaptation of the crop to the soil, by planting three and one-half by two feet, with a planter, and cultivating exclusively with the horse-hoe, his corn-crop, previous to last year, had averaged from sixty-one to sixty-five bushels per acre, and was raised at a cost of about thirty-three cents per bushel.

He further stated that New Hampshire expended three million dollars annually for corn; that the eight-rowed would produce seven or eight bushels more per acre than the twelve-rowed corn. Had used the Stockbridge manure successfully.

With all the modesty and reluctance of a school-boy making his first declamation, the Chairman of the Board exhibited to the audience a model of his corn-planter.

Mr. Walker spoke very interestingly and instructively on the same subject, and illustrated his remarks by some life-like colored illustrations of corn in its different stages of growth. He said that we must understand how corn grows in order to raise it successfully, and then took an illustration of the germ, which, when examined by the microscope, was found to contain a perfect plant and only needed moisture, warmth, and air to make it

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grow, and step by step explained the plant in the different stages of growth.

He made several good points for economy in the production of corn, as follows: Plant in large, regular, and rectangular-shaped areas, and cultivate by machinery. Prepare the seed-bed carefully and deeply, making a thorough incorporation of the manure with the soil to enable the rootlets to easily find nutriment; use the horse-hoe, but not the hand-hoe. He found the Victor pulverized the soil better and deeper than hoeing by hand. Better fodder, at less expense, is made by stooking than by topping the corn.

The speaker pretty convincingly answered the question, "Can we meet the Western competition in corn-raising?" by stating that New Hampshire produced one million bushels more last year than ten years ago, and that it can be raised here for less than forty cents per bushel, the present cost of bringing it from Iowa to our State.

In reply to questions, Mr. Walker stated that he plowed from eight to nine inches deep, and in shallow soils would gradually work the plow down to that depth, and have the furrows "lap" and not lie flat and level. He favored the use of the wheel-harrow, and of the cultivator-toothed in addition to the spike-toothed harrow.

E. C. Cogswell, a minister, an historian, a principal of an academy, and, last and best of all, a practical farmer, ably and clearly set forth some of the difficulties in the way of Northwood's farmers. They cultivate too small and too many plots, bestow too much time on the dry knolls, and neglect the valleys.

Mr. Hills thought division fences, and all others not necessary, a nuisance. Fields should be cleared so that machinery could be used in cultivating them. Even the garden should be laid out so that the horse could be used in cultivating it.

The good-sized audience of the afternoon was perceptibly increased in the evening to listen to the Secretary's talk on "Farm Improvements," that was commenced with the assertion that there were no profits in going in the "old ruts," and, although it might break the wheel, it was better to get out.

Mr. Adams said he could not tell the farmers how to procure

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the money to pay for the implements, but he subsequently told them to save the "littles" obtained from those crops that draw their sustenance from the air most largely; keep better stock; sell when a good price can be obtained; and, finally, to lay plans and use judgment, — which valuable advice didn't quite agree with the statement at the commencement of this paragraph, and Mr. Hills, who cracked many cutting jokes at the Secretary's expense and to the amusement of the audience, should have complimented his modesty. In this connection we will give our readers the benefit of a little information privately obtained from a reliable source, to the effect that the main cause of the rapid wasting-away of the Secretary's slender form is that Mr. Hills's jokes seriously affect his sensitive nature.

Returning to our notes we find that Mr. Adams further said that many implements could be used on the hilly farms, and that money expended in improving them was a judicious expenditure. He briefly described some of the implements most needed on the farm, and in the list were stone-pullers, plows, harrows, corn and potato planters, and sowers, cultivating harrows and drags (for pulverizing), garden tools, and, last, but not the least important, kitchen implements. The Planet, Jr., was considered the best corn-cultivator, and the Randall or the La Dow the best pulverizing harrow. Only one manure-spreader was used in the State, and it would not be universally adopted at present. Draining, and the removal of bowlders, division fences, and hedges, were alluded to as good methods of improving the farm.

Mr. Hills, at the commencement of his practical and plain talk on "Fruit-culture," said the previous speaker had used all but fifteen minutes of the time allowed for the whole meeting, to which assertion the Secretary promptly replied that his only object in speaking so long was to keep the audience awake during as much of the meeting as possible.

In resuming, the speaker said that it is necessary to raise some crop on the farm to bring in money, and that fruit is so largely composed of water that it lightly taxes the fertility of the soil. Prior to 1850 the statistics of the fruit-crop were not thought to be worth collecting. Last year the crop was estimated to be worth one hundred and thirty-eight million dollars in the United States.

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While Massachusetts is paying more attention to the cultivation of small fruits, it is not holding its own in the apple-crop. New Hampshire apples are demanded in Europe, and those from certain localities are much sought for outside of the State.

Instead of buying trees from the nurseries of New York, he advised the farmers to raise them by putting apple pomace in a drill with old compost. The following fall they should be taken up and the most thrifty ones heeled in. The next spring, transplant in rows four feet apart with eight or ten inches space between the trees in the row. The seeds of trees should not be allowed to dry before planting, and that can be prevented by covering with sand. Peach-stones should be planted in the fall, that the frost may open them, but those in the market should not be used, for the fruit is frequently grown on trees affected with the yellows.

The principal reason why peach-trees are killed here in winter is, that they are "forced" to make a large growth, thereby giving no time for the wood to ripen. They are planted in warm places where the buds are thawed every day and frozen each night in winter. To prevent that, plant in moderately fertile soil, where the sun will not thaw and swell the buds before the cold weather is past. Shade the trees with evergreen boughs, and mulch after the ground is frozen to keep the buds from swelling too early in the spring.

Grape-vines can be propagated by laying down or by rooting cuttings containing two eyes, one of which is placed above and the other in the ground. His choice for varieties was Concord, Moore's Early, Hartford Prolific, and Worden's Seedling. By laying down the vines in the fall and lightly covering with evergreen boughs, the time of ripening will be advanced one or two weeks. The imperfect specimens of fruit should be early removed, to prevent the trees and vines from overbearing.

Strawberries and other small fruits are not luxuries and can be raised among fruit-trees. Recommended the setting of young strawberry-runners in three-rowed beds, and would cover to prevent the frost from "lifting out."

Would cut back the pear-trees to make the fruit-spurs grow.

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The trees are inclined to overbear, and should carry no more fruit than they can support unaided.

His explanations of the methods of budding and layering were much enjoyed by the audience, and many of the good points in his lecture we must omit for want of space.

Mr. Cogswell expressed his gratification, as did others, for the meeting. Mr. Cate thought the Board was progressing faster than the farmer, and Ezra Tasker offered a resolution of thanks to the Board, which was unanimously adopted by a rising vote.

The day following, the same party went to Bow Lake, in Strafford, where a lively meeting was held, some of the same topics being presented as at Northwood. The people of the village gave the Board a cordial welcome and a good attendance.

MEETING AT LITTLETON.

The meetings of the Board for Grafton County began Jan. 14 at Littleton, with a strong team, efforts being made to make the meetings of interest to the farmers in that place. The absence of your reporter [J. W. Sanborn for the "Mirror," from which we copy] from the morning session forbids much notice of its deliberations. Short talks were made by Messrs. Tuttle and Towne, and by Dr. Cutting of Vermont.

Dr. Tuttle, a recent appointment to the Board for this county, considered "Milking, and its Sanitary Relations as a Food." As a propagator of disease he pressed foul or impure milk a point farther than has been common, asserting that foul milk from materials (manure, etc.) gathered by slovenly milking is a prolific cause, or a cause, of typhoid fever. This view he enforced by a short talk.

Mr. Towne of Lancaster gave a talk on general farm matters.

Dr. Cutting of Lunenburg, Vt., gave some results of chemical fertilizers used as experimental sets. By the kindness of the speaker, I had an opportunity to consult his tables, and will abbreviate, giving simply the amount of fertilizer used and product of oats: No manure, 16½ bushels; yard manure, thirty loads, 26⅞ bushels; nitrate of soda, 400 pounds, 15 5-6 bushels; dissolved bone-black, 600 pounds, 45⅝ bushels; muriate of potash, 400 pounds, 12½ bushels; nitrate of soda and dis-

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solved bone-black, 58¾ bushels; dissolved bone-black and muriate of potash, 54⅜ bushels; nitrate of soda and potash, 28¼ bushels; nitrate of soda, potash, and dissolved bone-black, 1,300 pounds, 40 bushels; plaster, 400 pounds, 27 13-16 bushels.

For the afternoon opening, the chairman introduced Dr. Cutting. His topic was "Weather Signs." The doctor proceeded to give a review of historic notions of the ancients in regard to the air and wind. His review was too full for the report. In short, various notions prevailed. Among others, that spirits or gods stirred up the wind from the caves and mountains of the North, where it resided, and furious winds were hurled over the country in the anger of the gods to punish the sins of the people. Moderns ascribe the wind to heat, electricity, revolution of the earth, and atmospheric tides. A globule of water was a hollow sphere, and, theorizing, many suppose that in the clouds it is hollow and filled with electricity that buoys it up, for water, being heavier than air, would fall without some agent to sustain it. In summer it is the condensation of moisture in a damp atmosphere that causes rain.

With a barometer to indicate weight of atmosphere, and a hygrometer to measure its moisture, we can very surely indicate the coming weather. By their use the past season he had secured seventy-five tons of hay without getting any wet, and at less cost than his neighbors. A substitute for the hygrometer could be had in a pitcher of cool spring-water, or ice-water at 40°. If the pitcher shows moisture immediately on pouring in the cool water, it is sure to rain, for the air is laden with moisture. If it is some time, say ten minutes, before the pitcher sweats, as it is termed, no rain need be feared, as not a sufficient amount of moisture exists in the air to cause a rain. By close observation of these instruments, and even of the barometer alone, he believed a very great advantage could be gained to the farmer. But it needed close attention, else it was entirely valueless and even misleading. He observed his two and three times an hour, and sometimes when anxious got up two or three times in the night.

Most of the old signs in vogue among farmers rested, he said, on good scientific bases. He then proceeded to read some

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queer old verses embodying the weather signs and their indications, after which he took up those signs, one by one, and pointed out the truth upon which they rested. They were too many and full to undertake to give. A few instances may be named, however. His reasons were given, but I will give only his advice, offered with much assurance.

"Go fishing on low barometer." When spiders build their webs flat, fair weather may be expected; and when at an angle, dull weather. The latter statement was true with slight exceptions. Calms do not exist during change of weather. Storms come from the direction the wind blows at two or three o'clock A. M. Damp walls and smelling ditches indicate rain. The atmosphere being humid, deposits moisture on walls, and the rare atmosphere, as indicated by the barometer, is not dense enough to float gases above our heads, and thus they come to notice. Several plants were noticed as good weather-indicators, chickweed especially, and dandelions, whose down closes for foul weather. 'It is sure to rain if the sun does not dissipate fog in the morning, for the atmosphere is very humid. If ants' holes are not clear, foul weather may be anticipated; and if open and wide, fair weather may be depended upon. Curled clouds are fair-weather clouds; cloud-capped mountains generally assure dull weather; and soap-bubble formations from dropping rain on water, after the storm has continued awhile, indicate clearing up; at the beginning of the rain, a continuing rain. Almanac predictions he sat down on quite hard, giving reasons.

The reasons named by the speaker I have not attempted to repeat in a brief report, wishing to call attention only to a few signs thus indorsed as resting, by his views, upon scientific data, thinking that the reported matter may serve to increase attention to commonplace signs about us more carefully and thus test their merit. From limited observation I am satisfied that the barometer is a great aid, probably greater when checked by the hygrometer.

Mr. Sanborn followed Dr. Cutting on "Farm Machinery," as in other places.

"Manure," by Mr. Towne, was first discussed at the evening session. Mr. Towne was emphatic in his advice to save all the

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waste about the premises. We make our ashes into soap, thus using our potash which goes with the suds into the sink-waste. This valuable waste should be utilized; loam should be used under hen-roosts, where droppings are as valuable as guano. Our wastes are enormous, in the aggregate, that flow from our farms to foul our streams. London consumes the product of twenty thousand acres daily, the waste from which pollutes the Thames and is lost to our art. Green manure made early should be plowed under quickly. Leaving the small heaps to leach and run off is bad policy. Would plow under in the fall and save once handling. The manure made annually from one cow is 31,000 pounds solid and 8,000 pounds liquid. Actual test found one cow of ordinary consuming capacity ate in seven days 87 pounds of potatoes, 167 pounds of hay, and drank 612 pounds of water, and voided 590 pounds of solid and 154 pounds of liquid manure, the balance, 122 pounds, being milk and waste. This urine is very valuable, — can you afford to lose it? for 100 pounds of it contain 30 pounds of valuable salts. If no cellar is under the stalls, take up the floor once a year and clean out. As an absorbent, for it should be used, — good muck is valuable but not plenty, — use good, rich loam. A cord of manure has the elements that are in one and one-half tons of hay.

"What is Nitrogen?" was the problem that Prof. Blanpied of the Agricultural College assigned to himself to clear up and to familiarize the audience with. This is the first opportunity that Prof. Blanpied has secured from his college duties of meeting with the Board and farmers. He treated his subject from the stand-point of the chemist, without attempting to lengthen his hour's talk to cover the field of its specific relation to plant-growth and its economic relation to food-production. Constant illustrations were made by materials prepared in the laboratory, adding interest to his lecture, which held the close attention of the audience.

Nitrogen was defined as a colorless, odorless, and tasteless gas, constituting four-fifths of the bulk of the air; mixed with oxygen it serves as a diluent; in pure oxygen life goes on with increased activity and burns out fast. In addition to these materials, the air contains carbonic acid amounting to only one

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twenty-five-one-hundredths part, yet it is sufficient to furnish the carbon found in plants. Oxygen, like nitrogen, is a colorless, odorless, and tasteless gas. But here the analogy ceases; oxygen is a supporter of combustion, while nitrogen is not. The slow union of the oxygen of the air with the carbon of wood or decaying matter is combustion, and is attended with the liberation of heat in the same amount in the one case as the other. The larger the proportion of oxygen the more rapid the combustion. A draft of air facilitates combustion by thus introducing a fresh supply of oxygen. In pure oxygen combustion is very rapid. In it iron will burn with scintillation, as was illustrated by the speaker, in common with other statements. Speaking of bone phosphate, he proceeded to state what it was, being three parts of lime to two of phosphoric acid. In this state it was insoluble in water. By treating it with sulphuric acid, two parts of lime are withdrawn from the bone, and there remains superphosphate of lime, which is soluble in water.

Returning to the consideration of nitrogen, he said that as nitrogen alone it was not available to plants, but in combination with other material. In union with hydrogen it formed ammonia, or hartshorn, drawing its name from the fact that it was originally distilled from horns, particularly those of the hart. Ammonia is formed from decaying vegetation to which air has not free access; under free access of oxygen nitric acid is formed. One one-hundredth of a grain of it is found in a cubic foot of air. Nitric acid formed in air unites with ammonia and forms nitrate of ammonia. Farmers speak of fixation of ammonia, done by adding acid. Plaster is used for this purpose. The sulphuric acid of plaster unites with ammonia and forms sulphate of ammonia, which is non-volatile, but easily soluble in water. The availability of nitrogen under the influence of electricity for plant-growth has been asserted by scientific men. He could not indorse this opinion, but should judge that nitric acid would be formed and availed of by the plant. This lecture was well received.

Mr. Goodell followed Prof. Blanpied, and gave one of his usual forcible and pointed talks. Discussing the question of whether farming paid, or could be made to pay in this State, he

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remarked that either side of the question had been taken. Kid-gloved farmers had written glowing accounts of the pleasure and profit of farming who knew but little of its actual problems. Often farming does not pay under adverse conditions, and under such conditions should be abandoned, for but a miserable existence can be eked out. It does not pay unless managed by skillful men. It was a mistake to suppose that men not qualified for other business were qualified for farming. Many of our successful farmers were not brought up on the farm, but came to the farm with active, discriminating habits, and quick to learn by, and to rectify, their mistakes. Like the business man, we must be ready to make quickly such changes in our methods and appliances as changes demand. We want not only to keep abreast of the times, but ahead of them. We are called upon now to avail ourselves of the improved machines at our command. We must, if we wish to succeed. The speaker considered the prospects of farming unusually bright; in fact, never better. Speaking of Jerseys, he observed that he would not give much for them for New Hampshire hills. The tedder was advocated. Puts it at work immediately after mowing, and again the first thing in the afternoon, and puts hay into one mow the same day successfully.

Mr. James O. Adams followed Mr. Goodell in a brief closing talk, considering, first, labor-savers for the household, calling attention to dairy implements, butter-workers, etc., and advising the liberal purchase of dairy labor-savers. Attention was called to the centrifugal cream-separators, or churns. Alluding to corn, he stated that a bushel could be raised for thirty-five cents. Mr. Sanborn, on the college farm, he said, had raised it for much less. One-half acre of corn, he said, would produce as much human food as one and one-half acres of wheat. Remarks were made upon the profits of putting up articles for sale in inviting packages. He illustrated by a gentleman who put up his apples in the cleanest of barrels and packed in an orderly manner. Extra pay was got. Mr. Adams closed with a few witty remarks that always come so handy to him.

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MEETING AT LISBON.

The members went, next day, Jan. 15, to Lisbon, where they were joined by Col. Mead, superintendent of agricultural affairs in Vermont.

"How he brought up his Farm," was told by Mr. Towne of Lancaster. Said the speaker, success in farming lies in the manure-heap. It was his constant thought from morning until night the year through. Starting with a farm cutting from eighteen to twenty tons of hay, he had, by constant efforts to save and make manure, using muck freely as an absorbent, succeeded in cutting, in fifteen to twenty years, one hundred tons of hay. To do this he had bought but four loads of manure and no fertilizers, but had reclaimed some river meadow-land that was considered worthless. He had so little manure to begin with that he had to manure in the hill at first, but, by putting muck everywhere it could be used, he soon had an abundance to spread. By saving all wastes, — for it was not by hard work that success comes, — he had to add one barn after another until he had added the third. He had used on his land where oats lodge seven bushels of seed per acre, seeding for grass in August, or, if not then, in November, to prevent seed starting and thus being killed by frosts. Seeded clover in spring, and would cut timothy after out of blossom. These last three methods were much discussed by Messrs. Goodell, Mead, Sanborn, and others, and that from two to three bushels of oats per acre were sufficient, was the generally accepted conclusion; that seeding with grain for grass would answer if the grain was thinly sown, and if the catch was not perfect to seed lightly in August; that it was better to seed in August, and, if not then, to be deferred until November, seeding clover in the spring following. It was thought by Mr. Goodell, that, while Mr. Sanborn's experiments at the Agricultural College were against early cutting for steers, he would cut early for cows. In further talk Mr. Towne said that he put in two tons of hay per day per man.

"How to grow Steers at a Profit," was next discussed by Mr. Sanborn. The speaker laid down the principles essential to be observed and necessary to follow, if success is to be obtained.

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The principles enumerated were enforced by experimental results at the college.

Indorsing Mr. Sanborn's talk and continuing the subject, Col. Mead said science is not a bugbear, and farmers are no longer afraid of it. It is a settled conclusion wrought out and accepted. Honorable account was given of his experience with cotton-seed meal. Excepting for butter, he criticised severely the Jerseys; thought that for other purposes much harm had come of their careless increase. He was acquainted with a man in Vermont who was maturing stock early, as advocated by the speaker, and at fifteen months old was getting thirty-three dollars. In course of further debate by Col. Mead, Messrs. Goodell and Sanborn, steers at two years of age were named that weighed 3,300 pounds; six months' calf, 680 pounds; winter calf, first of September, 600 pounds, — in fact, several of such; at six months 720 pounds, and 1,200 pounds at twelve months.

"Grass" was Mr. Goodell's subject. He thought a great failure, or the great failure, of farmers was in not using what they know. As a general thing he thought they knew enough. To those who would use what they knew, he thought the future was promising in farming. We should need to display the energy and activity of business men, and use all of the appliances of the day. The attractions of the calling were briefly and pointedly noticed. Proceeding to discuss the grass question, he was emphatic in his advice to manure for the grass-crop. He thought the custom of fertilizing high for the corn-crop and then taking off an oat-crop, seeding down to grass without re-manuring, all wrong. We should get our profit from those crops for manuring, and then furnish for the first start of the young grass fresh manure, for it needs manure at command. The first starting of grass-roots was vital to the success of the crop. In seeding down would not mind seeding down with oats. Farmers generally consider oats a poor crop to seed down with. He did not so consider it. The trouble is, we seed heavier to oats than with other grains. If we seed no heavier to oats than with other grains, a good result would be obtained. He uses from one-half to three-fourths bushel of herd's-grass per acre. In seeding light to oats, ninety-six pounds of seed for two acres,

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he had received one hundred and thirty-one bushels yield. In answer to a question, Col. Mead said that he had grown Alsyke clover and liked it, although he was not now growing it.

Mr. Whitcomb of Bath followed these gentlemen in a description of a model barn yet to be built.

Col. Clough favored the audience with a short talk, at the opening of the evening session. The colonel was unusually hopeful and very enthusiastic. We are, says the encouraged speaker, yet to see the brightest day that our agriculture has ever witnessed. Of all times, boys, don't leave the farm now. Farmers' clubs, granges, boards of agriculture, and agricultural colleges are diffusing knowledge with great success. There is no crop with so great recuperative powers as the corn-crop. Buying corn is one of the most foolish of practices. The speaker came out heavily against the habit of doing farm work by horses instead of oxen. We must have farm stock. We can cheat our neighbor, but we cannot cheat our farms. A dollar in farm improvements was better than in bank stock. The necessity of sheep, hogs, and stock was shown, for we cannot farm without the manure-heap. A characteristic description of the farmer who does not make it pay, was given.

An elegant and suggestive address on the subject of "Dairying" was given by Col. Mead. Confidence was expressed in the success of the dairy interest in Vermont or New England for the future. While the West had taken some premiums for butter over Eastern, he was confident that the time will never come when they will make better butter than can be made here. The average production of butter per cow for Vermont was one hundred and eighteen pounds. For the last ten years there it had not paid to make butter, as an average result for the State. Skillful men had done better. He knew of neighborhoods where the average result was two hundred and twenty-five pounds of butter per cow, and single herds of three hundred pounds. Mr. Skinner had got his herd of five cows up to over four hundred pounds apiece. He had not allowed any one but himself for once for three years to tend or milk his cows. He sold his butter for nearly fifty cents per pound. A neighborhood was cited where, twenty years ago, the average was but one hundred pounds

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of butter per cow; now, after good breeding and selection, two hundred and twenty-five pounds were received. He had seen a lady in Boston call for a special stamp of butter and pay one dollar a pound for it. He was told that there was a plenty of butter just as good, but this lady always found that sample good and was willing to pay. Uniformity made value in butter. We should know more of the individual merits of our cows; and, if making butter, swap the cheese-cows of our herd with a cheese-maker, taking his butter-cows from his herd that ought to contain cheese-cows, and thus both would be benefited. Trial had shown that mixing milk of dissimilar cows was attended with much loss. He believed in high feeding. Had staid with a man over night who sent a dog on to the hill a half-mile for twenty-one cows that were run down the hill, and saw the milk carried in, in three pails. Told the man that it cost him fifty pounds of butter per cow to get his cows driven by a dog. Another successful dairy-man sends his laziest man for the cows. Winter butter-making was advocated, to be sold fresh as made. A gentleman who sends butter to Japan puts it under brine, and it arrives sweet and nice.

Speaking of reviving sheep-husbandry, he said that sheep for breeding have been sold for one thousand dollars this fall in Vermont. He advocated specialties in farming, for the field was so broad that no one man was smart enough to know it all. Mr. Hammond had said that it was impossible to be a good sheep-raiser and run other business. It is the tendency of the age to give undivided attention to one thing; thought the prospect for farmers was bright. The field for investigators was abundant. In answer to questions, said he believed in shallow setting in large pans.

Following this address, the Rev. Mr. Mack, of the Orphans' Home, gave a short talk in response to call. The witty things said that kept the audience in a laughing mood are not easily reported.

A short closing talk was made by Secretary Adams.

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MEETING AT NORTH HAVERHILL.

The Board held three sessions at North Haverhill Jan. 16. The frequent, almost perennial visits of this organization have been the result of the earnest solicitation of its citizens, — an evidence that the efforts of the Board are appreciated. Undoubtedly, the gentlemen of the Board consider this appreciation as the product of the critical discernment of Haverhill farmers. It may be justly said of Haverhill that it is an unusually good farming town, and that its farmers are wide-awake and looking always anxiously for whatever is promising in agriculture. Secretary Adams (also appreciative on his part probably) arranged for a strong team at this place, for we found on the ground as aids Ex-Senator Patterson, Col. Mead, Editor Tinkham of the "Green Mountain Freeman," and the genial chemist of our Agricultural College, Prof. Blanpied.

The meeting was called to order promptly at ten o'clock by Mr. Sanborn of the Board, and, with the exception of short adjournments for meals, the time was crowded with practical talk until a late hour in the evening.

Mr. Goodell of Antrim opened this session with a discussion of "Grass," and pursued very closely the practical details of grass-culture. The subject, both by the speaker and the audience, was treated more fully than at Lisbon, and calls for additional notes. The discussion of curing hay was full and on the side of short exposure to sunshine. Mr. Goodell said that gathering the first day decreased risk of storm five times; for, if housed the first day, it is exposed after cutting but about six hours; if gathered the succeeding day, it is exposed thirty hours. After tedding twice, as before explained, he commences to draw early in the afternoon. Before the dew falls he wants it all in the barn, and while it is yet hot with the warm sun. To keep, he has it carefully spread around and in the corners and well trodden. This practice he learned of John Johnson eleven years ago, and attempted it at first with some misgivings, but after years of experience was entirely satisfied that if directions were followed success would be assured. Packing it well served to exclude the air, and preserves it much as the ladies preserve fruits. The outside will be blackened a little, and if the bottom

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of the mow is poorly protected the bottom of the hay-mow will be injured, and the top always gathers moisture from below, as the hay dries, for the hay will come out as dry as by the old practice of curing. A neighbor of his had tried the practice on his recommendation, and as soon as it began to heat put the pitchfork in; and then, after having done that which would defeat his purpose, said the practice was a failure. He cut hay one-third part clover and standing two tons per acre, and put in the same day. Several indorsed Mr. Goodell, including Col. Mead, who seemed even more radical, and would put in clear clover the same day as cut. Mr. Goodell wanted a mow filled in three days. He wanted it filled, or filled his, in one and one-half days or sooner, for fermentation begins immediately as soon as hay is put in. In culture he believed in manuring light and plowing often. Much failure of the seed of grass to germinate was due to putting in too deep with harrows. He brushed in. He prefers Northern clover to Alsyke. The Western has too much of plantain-seeds in it.

Secretary Adams followed with suggestions in relation to ensilage. He said the Germans conserved green clover by pitting. Silos for this purpose had not been introduced into this country, with the single exception, of recent date, of Dr. Bailey's experiment. A description was given. In speaking of the beet-sugar industry, he said the evidence was not sufficient as yet to settle the question of its success. Dr. Blackwell thinks this year's operation by their company will decide that point either for or against. Seventy thousand dollars' worth of sugar had been sold, and they now had on hand, in the process of manufacture, eighty thousand dollars' worth more.

Following the remarks of Secretary Adams, a short discussion of "Root-growing for Stock" was considered. Col. Mead and others were sure it was profitable to grow roots for stock-consumption. In answer to a call, Mr. Sanborn said that root-culture could never become to American agriculture what it had to English, for the conditions were widely dissimilar. The English climate, open during the winter, enabled the English farmer to feed roots off the ground, and thus avoided carting the roots in and the manure out, to a large extent. The cost of handling

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ninety-two to ninety-five per cent of water for five to seven per cent of food materials, and cost of protection from frost, and feeding, would always restrict root-culture in our climate. A few might be grown to feed off in the fall for mutton sheep or any stock that would take it on the ground. This would help out the fall feed. Two years' experiments with Swedes by careful weighings had returned but little more than six cents per bushel, a price that was not satisfactory for the work involved. He understood that that was full as good a return as the English received. But it should be stated that the soil of the state farm is clayey and of the kind that is supposed to bring poor Swedes. So far, although strongly pressed for a long time, root-culture had increased very slowly indeed, and still had its most persistent advocates among what are termed amateur farmers, who in succession break the silence of their predecessors in regard to root-culture and its relation as sheet-anchor of American farming. Roots would have their place, but not a decidedly prominent one.

Although out of the regular order of discussion as it occurred, I must not omit to name a few thoughts from Col. Mead, or through him from Prof. Peter Collier of the Government Department of Agriculture, in regard to sugar-production. According to Col. Mead, Prof. Collier thinks farmers had better go slow in sugar-beet production; that corn or sorghum, not beets, should be our source of sugar. Which will be the most economical, sorghum or corn-stover, is not known. The stover is best for sugar when in best condition for corn, and its pulp can be fed as well as beet-pulp, although it needs to be immediately. Farmers in this culture will press their own sirup, and sell it to, or send it to, a company to be crystallized into sugar.

Mr. Jackson of this town exhibited an amber sugar-cane and some sirup made from a little patch of it grown in his garden. He pressed the sirup out with a shoemaker's roller. Prof. Collier, according to Col. Mead, considers the Early Amber the best and suited to our climate. The old-time discussion of the effect of turnips on the flavor of butter was fully discussed, including effect of time of feeding, with the usual negative result. Some one suggested that it was the turnips outside of the cow

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that flavored the butter. Another credited Prof. Dimond with the original remark at one of their farmers' meetings that he knew that turnips fed cows flavored the milk, for his wife tasted it ten days before he gave turnips.

The meeting was opened in the afternoon by Mr. Sanborn in discussion of the mutual question of New England farmers, "How to Renovate, quickly, thoroughly, and profitably, Worn-out Farms."

Col. Mead followed, and gave a full indorsement to the system proposed by the first speaker. Col. Mead discussed the fertilizer question somewhat. Judging from the drift of his remarks he is unfavorable to formula fertilizers, but thinks well of arranging fertilization in such a manner as to ascertain the needs of individual soils. The strength of a fence is the strength of its weakest point, said the speaker. If a soil is deficient in a single material of plant-growth, that weak spot measures the capacity of the soil for plant-growth. Referring to other sources of fertilization, he said Dr. Cutting of Vermont bought old barns that were to be had cheap, and removed several feet of earth from under them. He paid fifty dollars for one that he saw, and the dirt from under it, dug six feet, which Col. Mead estimated at one hundred dollars.

"The Agricultural College" was the text of Prof. Blanpied's talk, and pursued in the line of its history and present prospects and work. It was endowed by the sale of land donated by the government amounting to eighty thousand dollars, and evidently sold for less than what it was worth, as Vermont received one hundred and twenty-five thousand dollars for hers. (Col. Mead said, more.) The money was invested in state bonds. David Culver had given twenty-five thousand dollars to Dartmouth College to be held in trust for agricultural purposes. This had been invested in building, with the aid of the State, Culver Hall. John Conant of Jaffrey had paid largely towards the purchase price of the farm and Conant Hall, thus giving to the Agricultural College the finest building in town. Mr. Conant has also given thirty-four scholarships. The college was out of debt. This was accomplished by aid of the State. The college would not need or ask further aid from the State for itself, although he

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thought it should give free scholarships to such of her sons as should choose to attend the college. There are now thirty-one scholars, more than ever before in its history. They expected with confidence about forty for next year, and were looking for more. Thus the present position and outlook of the college was hopeful.

The relation of the two colleges and of the students of both to each other had been a matter of much comment. That there had been some taunting of our boys at first, we could not deny. The Agricultural College was somewhat in the attitude of a new boy in town, to be tested, not out of malice so much as curiosity, to see what stuff they are made of. He was a Methodist's minister's son, and had, when young, to follow his father in his annual change that was made by his church's practice. He had thus become a new boy in sixteen different towns, and had to submit to the twirling of his hat, pinching, and other annoyances that are the common lot of a new boy in town. Sooner or later such a boy has to fight. Thus his sixteen different towns had witnessed sixteen different fights, and, as you may judge by my stature, I generally got the worst of it. Whatever the result, I had established my right to become one of them. The college had gone through that period of its history and its course runs smoothly.

The college had two courses obligatory upon them to teach, by the government endowment, agricultural and mechanical arts courses. Those taking the latter course do not usually turn their attention to farming, and farmers noting it say that the boys are educated away from the farm. This is unfair. Of the number taking the agricultural course, by investigation two years since, nineteen-twentieths to that time had turned their attention to farming. He had not had occasion to inform himself since. This was a better showing than any college in the country could make in that respect. The course of studies was then outlined, and criticism challenged. Its cost was cheaper than an academical course, being but little over one hundred dollars per year.

Secretary Adams followed Prof. Blanpied, pointing out several advantages of the college for farmers' boys. This he did not

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say, he stated, on account of any courtesies that he might have received from the trustees, but because he believed it merited it. The opposition did not come so much from the boys as from those who should be fathers to it. Quoting from occurrences, he then indicated that the head of Dartmouth College was the principal in any conflict that might exist between the two colleges.

Prof. Patterson followed in a few words in regard to the social status of the college, saying that such feelings on the part of the old college to the Agricultural College, as were acknowledged by Prof. Blanpied to have existed, were a common experience. The scientific department met with the same friction on its first establishment, but it had all died out, and harmony existed and might continue to.

At the evening session, a crowded house greeted the speakers, and a crowded house by a crowded list of able speakers, each one of whom inspired good feeling in the audience by some well-timed story or joke in illustration of practical topics.

Dr. Mason, of the Board, gave part of his usual address on "Veterinary Science," filling the balance of his time discussing "Pleuro-pneumonia," whose supposed presence in town gave every one a lively interest in it.

"Farm Recuperation" was discussed by Prof. Patterson. Combining the scholar, the orator, and the logician in one man, and all New Hampshire citizens know that Prof. Patterson is rarely surpassed, I may be pardoned for saying to my farmer readers, that when he takes a farm topic, he is true to his subject and his reputation as a speaker. Why this, you say? Well, it is not wholly unsatisfactory to learn that those who go out from among us to other callings, and to success, retain the impress of early farm education and democratic sentiments common to them, as is the case with our speaker.

"Education of the Farmer" was the subject of an interesting talk by Col. Mead. I heard some one observe that it was good, as it was. He would give the coming farmer a liberal education in the sciences against time in the classics, particularly those sciences that bear on his calling.

The next speaker was Editor Tinkham. In a very few mo-

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ments many good things were said. Nothing more pointed, however, than that it is carrying farm mechanics a little too far when we undertake to run our barn-yards by water-power. The moral was never better enforced.

Dr. Watson, of the commission appointed by the governor and council, devoted a few minutes in explanation of the local cattle disease.

Secretary Adams made a short closing talk, and, after a few sharp jokes between the Secretary and the gentleman from Belknap County, the goodly audience adjourned at about half-past nine o'clock.

I would wish the hospitable farmers of Haverhill success, but I feel assured that they are of the kind that have it.

MEETING AT AMHERST.

The "Nashua Telegraph" reports as follows: —

A farmers' meeting was held at the town-house in Amherst. The attendance, owing no doubt to the storm, was small. Mr. D. H. Goodell of Antrim presided, and it was decided to talk about "Grass, and the Best Methods of Curing It."

Mr. Joseph B. Walker of Concord was the first speaker. He said the vital question to milk-producers and farmers is, "How can we reduce the cost of hay?" The average farmer is too much inclined to be satisfied if he comes out even at the end of the year. He ought to do better, and get beyond the point where the farm simply gives him a living. Farmers should plow up their ground as often as once in five years — the old rule was once in ten years — and thus prevent the land from becoming hide-bound. Manure it well; distribute it well. Ground that is not plowed often has a foreign substance to grass; it has dead roots and barren spots. The grass is poor. He also advised farmers to be particular about sowing grass-seed on grass-lands, which are moist. Again, look after the quality; see to it that the growth is even; that there are no polypod and noxious plants in it. He had often lost two or three dollars on a load of hay because of twenty-five cents' worth of foreign substances. He further advised irrigation where it is practical; dam up the streams and use the water upon the grass-land at the proper

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time, and this will largely increase the crop. The best time to sow grass-seed is in the latter part of August or the first of September. Do your breaking-up in the dull days in haying-time and after. Harrow the field well; roll or brush the ground. In October there will be a carpet of green three inches high; this will be rooted so as to stand the winter weather. The next season you will get a fair crop. Ground that is only raising a ton and a half of hay to the acre is unprofitable, and should be plowed, fertilized, and reseeded. In answer to an interrogatory he said he did not sow clover; he preferred herd's-grass; it commands a better price in the market. There are other varieties, however, that are desirable in some soils, Hungarian and one or two other kinds among them. He believed that sowing grass by hand is not a success; the seed cannot be distributed evenly; a seed-sower is important to all farmers. In response to some questions Mr. Walker said he was not prepared to condemn witch-grass. Cattle eat it well; it was good for horses; stable-keepers do not condemn it.

Mr. Moses Humphrey of Concord thought grass-land should be plowed once in four years. Plow directly after haying. Plow light, say three or four inches; the grass being turned with the manure will cause fermentation, and assist wonderfully in fertilizing. Use the wheel harrow. The soil should be as fine as garden loam; it can be easily sown with a good harrow. In plowing use a side-hill or steel plow; one pair of cattle will do the work with these which it would require two yokes to do with the old iron plow. Mr. Humphrey urged farmers to follow the example of manufacturers by obtaining the best machinery and farming utensils in the market. It will pay. He urged a judicious use of chemical fertilizers. It had been his observation that it would pay. A good many farmers, however, do not use it because they have an idea that it would not hold out the second and third years. If it pays well the first year, the farmer should be satisfied. If he gets four tons of hay where he could get only two tons without it, and the cost is eight dollars, it has paid handsomely; then why whine? It requires more brains and skill to be a good farmer than it does to be a good mechanic. Different soils need different treatment, and "brains and skill"

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must determine what is the best crop for different soils. There are a good many general principles about farming, but farmers must be governed in a large degree by their soils.

Mr. Walker said he sowed about one-half bushel of grass-seed to the acre. He thought that an extravagant amount, as others had had good results from a peck of seed. He had used the refuse lime of a tannery to fertilize his grass-land, and obtained good results.

Mr. Humphrey said he had discovered that Hungarian grass is the best for working cattle and horses; he believed it was good for milch cows, but was not prepared to advocate feeding it to them. It was the easiest grass to raise; should not be heavily manured, as it will grow stocky and woody, and thus be less nutritious.

Mr. Goodell of Antrim was the next speaker. He advocated an endeavor on the part of all farmers to raise the best; it was the best for their own use, and found a better sale in the market. The old plan of curing hay is decidedly faulty. He had experimented by filling a mow solid, in one day, with green grass. He supposed it would be spoiled. Six inches at the top was black, but below that it was the best hay he ever saw; he found that cows would give as much milk upon it in March as they would in June upon June grass. Cattle like it better and thrive upon it. He experimented again, and the result being satisfactory he has continued to put in his hay-crop in this way ever since. He now puts some old hay upon the top of it, which takes the moisture and leaves the hay without the black top as at first. The hay when put in must not have any dew upon it; must not be cut in a lowery day or following a storm. It should be cut late in the forenoon, worked over once or twice with a tedder, and put in before late at night. The scaffold or bay must be filled inside of three days, else the steam that arises will streak the hay and spoil it. The advantage is twofold — the labor is less, it will produce more milk; it will produce more flesh upon cattle. Again, there is less risk; less, because a farmer who cures his hay in one day can generally determine in the morning what the weather is to be, while the farmer who cures his hay in two days cannot determine, and is

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therefore liable to have a portion of his crops spoiled. He argued that this principle of curing hay is the same as the principle by which fruit is canned. By the method advocated the hay is put into the mow or upon the scaffold in the best possible condition, and by keeping the air from it as much as possible its goodness is kept intact. He believed this method all right for curing hay for the market.

Mr. B. F. Hutchinson of Milford said he had tried this system, and the result had been the same as related by Goodell. Mr. Humphrey said he had always cut his hay on this principle. He now works but one day on hay. He is not as particular about it as Mr. Goodell, and his had always come out nice in the spring and found a ready sale. There is no dust in hay cut and stowed in this manner. Meadow hay may be cured in the same way.

Mr. J. O. Adams said one of the secrets of the system was in the fact that the oxygen of the air is excluded. The tighter the barn and the mow, the better the result. In response to an interrogatory Mr. Goodell said that green oats cannot be kept in this way. He had tried it and failed. Oats must be thoroughly cured.

Following a collation, furnished by the people of Amherst and those in attendance, there was some excellent singing by a select quartet. The chairman then announced that the theme for the afternoon was "The Raising of Corn."

Mr. Humphrey was the first speaker. One of the disadvantages in raising corn is in the fact that farmers plant in patches here and there instead of in one field. This method necessitates a good deal of lost time. He advocated that to raise corn successfully a farmer must select corn land. The land must be carefully prepared. It is a fatal mistake to heavily manure for corn. Over-fertilizing produces good corn-fodder and poor corn. The stalk grows so fast that the ears cannot put out. It is a good plan to run a cultivator and cut the roots. He does not believe in manuring in the hill; it grows it too fast. A light compost is good for the hill. Corn should not be planted on wet land; it will cost more to take care of it, and the result will not be as satisfactory. The outside rows of corn are not as good

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as the middle of the field, which, he argued, shows that it does not need the lateral sun so much as supposed. He advocated planting corn near together; also planting with a corn-planter. He had raised sixty-five bushels of corn on land that was too poor to raise mullein-stalks, by the use of Stockbridge fertilizers, and at a cost of thirty-three cents per bushel, charging the land with taxes, labor, and interest. Good barn-yard manure will produce about the same result. His experience had been that the eight-rowed corn is the most profitable to grow. It will produce more corn when shelled than the twelve-rowed, and the fodder is a good deal better. He would plant corn on the same land year after year, and told of a farm where good corn had been grown for fifty-two years in succession.

Mr. Burns never supposed that the "poor outside" row was the result of too much sun and dew. He supposed it the result of plowing a little outside, to be sure that all the fertilizer is utilized. Corn planted in the shade of a building or under a tree is not thrifty.

Mr. Humphrey said he had been misunderstood; everybody knows that corn will not grow under a tree or wholly in the shade. The natural shade of a field was what he was talking about.

Following another song by the quartet, Mr. J. B. Walker delivered an address on the "General Drift of Agriculture in New Hampshire." The drift has caused the price of farms to advance, and the farmers to purchase labor-saving machines. The drift has been in favor of education; the Agricultural College is doing a good work; the Board of Agriculture is doing a good work. The drift has been in favor of mechanical appliances in farming. The speaker then mentioned some of the many machines and inventions that have been introduced into farming, and spoke some encouraging words in relation to the progress that ought to be made. He would have some sort of electricity to stir up the dormant energies of men; a generator to give new courage; an arrangement by which the cradles of the past generation may be filled with young Yankees. Mr. Walker discussed the drift of competition and many other kindred topics in an interesting manner, and gave some instructive

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hints on the manner of making farms so attractive that the young people will be willing to stay upon them.

A gentleman whose name was not given by the chair, addressed the meeting briefly, giving it as his observation that the empty cradle is the result of education. The higher the culture, the less the number of children. He had four; had he been educated and cultivated one would have sufficed.

Mr. D. H. Goodell then spoke on topics of interest to farmers, making his observations in the matter of farming and farm life, longevity, customs, habits, fashions, etc.

MEETING AT BEDFORD.

A meeting was held in Bedford, March 4, which was reported for the "Mirror" as follows: —

The farmers of Bedford don't hold meetings every week nor yet every winter; but when they do gather themselves together they make a business of it, and are about as lively a bunch of agricultural professors as is ever found in New Hampshire. In the first place, everybody goes, regardless of wind and weather, and takes with him all his uncles, cousins, and aunts, and some strangers, and at the same time carries along the product of a baking-bee of a week's duration; so there is always a crowd, and enough to eat to give a whole regiment of gourmands the dyspepsia for life. There used to be one drawback, and that was the old rookery of a town-house in which the meetings were held; but now that antiquated structure has been replaced by what is undoubtedly the most commodious and attractive town-house to be found in any farming town in the State, — everything is perfect.

The meeting on Thursday was one of the best ever held in this section. The mud was of fabulous depth and it doubtless prevented the attendance of some, but there was a house full, and that was enough. Mr. Freeman R. French presided, and touched off the talkers, the first of whom was Mr. James O. Adams, who occupied a short time in a general talk, in the course of which he stated the *pros* and *cons* in the sugar-beet business, coming to the conclusion that we are not likely to see a factory established in New Hampshire very soon. Two or

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three points made may be new; viz., that subsoil plowing is essential to successful beet-culture, that beets weighing over two pounds each are not rich in sugar and are rejected by the manufacturers, and that large beets, containing not more than six or seven per cent of sugar, are best for feeding purposes.

He was followed by Hon. Moses Humphrey of Concord, who talked upon his favorite topic, "Corn," starting off with the proposition that he was a sort of monomaniac on the subject and grew more crazy the more he studied and experimented with it. His conclusions, all of which he based upon his own experience, of which he gave a very interesting account, are in brief these: That New Hampshire should raise all the corn she uses; that in favorable localities it can be raised for from thirty-three to forty cents per bushel, reckoning the fodder at twelve dollars an acre; that light land which will bear little or no grass, when dressed with twenty dollars' worth of chemical fertilizers to the acre, will bear from fifty to sixty bushels of corn; that a man having such land had better buy chemical instead of stable manures at five dollars a ton; that land will bear corn thirty, forty, or fifty years in succession without growing poorer; that corn-hills should be planted not more than two feet apart; that it should be planted and cultivated with a machine and that no hoe need be put into it; that eight-rowed is better than ten or twelve rowed; and that in manuring for corn no attention is to be given to a following grass-crop.

Mr. Humphrey stated that he had planted five or six acres of corn on the same ground for a series of years, doing all the work with a machine and using chemical manures, and got his crop into the crib at a cost not exceeding forty cents a bushel. His land is a pine plain of good quality. When he wishes to reseed his grass-land, he plows it as soon as possible after haying, pulverizes it with a disc harrow, dresses it with chemicals, and sows grass-seed at once. He gets a good crop the next year. In his corn-field he raises corn continually, and nothing else; uses just what manure the corn-crop needs for one year, having no regard for the next. Believes it does not pay to manure heavily, as it forces a heavy growth of stalks and gives few ears; plants two feet apart, four kernels in a hill; uses a planter of his own in-

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vention, which it pays any man who plants four acres to buy. Thinks stalks are worth six dollars a ton, and believes the time is coming when they will be used for making sugar. In the afternoon he spoke of the forage crops, saying he had had excellent success with Hungarian grass, which stock preferred to any hay. He could raise it on very poor land with the help of chemicals.

After replying to numerous questions propounded by the audience, Mr. Humphrey concluded, and dinner was announced. It was a great dinner; Bedford dinners always are great, and this was immense.

Hon. Joseph B. Walker of Concord opened the afternoon proceedings by a supplemental talk on "Corn." He said that the want of New Hampshire is more corn, and cheaper corn. The vital question is, how to get corn cheapest. The way to get anything is to go for it with all your might. Now, if we want corn, let us go for corn. Never mind what is to come after, but calculate to get the heaviest corn-crop possible, and at least expense. I plow for corn, manure for corn, and cultivate for corn. I manure for one year with the fertilizer best calculated to give the cheapest corn. In striking for cheap corn we must apply phosphatic instead of nitrogenous manure, because we go for corn and not for stalks. Take fifty bushels of corn and two and one-half tons of stalks, the product of an acre. The fifty bushels of corn contain chemical elements which sell in the market for eleven dollars and fifty cents; the corn is worth thirty-seven dollars and fifty cents; i. e., the corn is worth twenty-six dollars more than the manure costs, or leaves that amount to pay for labor and rent of land. The two and one-half tons of stalks contain fourteen dollars and ninety-seven cents' worth of chemicals. The stalks are worth fifteen dollars, leaving three cents to pay the cost of cultivation. What does this prove? That the profit on a corn-crop is on the grain, and not stalks. Then manure for grain, and not stalks; feed the crop with the food that will make the most grain and least stalk. Again: Plant your corn nearer together. How much does it cost to raise a bushel of corn? I think on good soil, with intelligent culture, we can make corn for forty cents a bushel, which is now worth seventy-five cents.

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We have some advantages over the West. It costs twenty-five cents to freight a bushel of corn from Chicago, and forty cents from Iowa, to Boston. We can buy chemicals to manure our land so as to make corn at less than thirty-five cents a bushel. It seems to have been proved that in some sections of the State corn can be made for thirty-three cents, but at forty cents it will yield a profit.

In reply to a question, Mr. Humphrey said he used four bags of Stockbridge fertilizer to the acre, sowing three bags broadcast, and mixing one with plaster and putting in the hill. His experience showed that land so light and poor that it will scarcely grass over, when treated with chemical manures would produce good corn. With him the Stockbridge manure succeeds with corn and grass, but fails on potatoes.

Mr. Adams then read a paper on "Improved Methods in Agriculture," pointing out numerous new departures, which, in his judgment, are necessary, and dwelling at considerable length upon the importance of procuring good seed for all farm crops. He referred also to the necessity of farmers' selling their crops in such shape as to carry as little plant-food as possible from their farms, and also of their adapting their aims and methods to their soil and surroundings.

Mr. Walker then spoke of "Forest-culture." After referring to the fact that half the area of the State is wood-land, and remarking that this vast interest was treated in the most shiftless and neglectful way, he said it had long been a question whether to thin out a wood-lot, taking out such trees as had stopped growing, or to cut clean as we go. He believed in the latter way, as the former caused great damage to thrifty growth by falling the large trees upon it and cutting roads through it to get them out. He believed in planting forests and making wood and timber a regular crop. We have a hundred varieties of valuable woods, and thousands of acres of valueless pastures and waste lands which we cannot reclaim by plowing. Trees should be planted on these lands and thinned out as they grow, so that they will stand at last in regular shape, and not crowd each other to death. He would trim pines by knocking off all the lower dead limbs once in ten or twelve years. A crop of

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wood can be raised in thirty or thirty-five years, and a crop of large timber in seventy-five years; and while raising it we can restore to the soil the fertility it has lost, and which we can give it in no other way.

Dea. Holbrook said he thought it depended altogether on the character of the wood-lot whether it should be thinned out, or cut clean, and gave his practice and experience.

Hon. George Foster, being called out, antagonized pretty sharply some of the ideas advanced by the visiting brethren. His experience told him to let pine growth alone until it was ready to cut. Trimming only damages it. He didn't believe, either, that it hurts land to manure it heavily, or that a heavy growth of stalks is not conducive to a heavy yield of ears. He buys stable manure and sells hay, and likes that way. His doctrine was to treat his land kindly, and he thought it paid.

Mr. Ward Parker of Merrimack made a brief speech, in which he advocated clover as the best of all the grasses for manure and profit generally; to which Mr. Walker replied that it was useless for him to raise clover, for he could not sell it. He wanted hay that he could turn into money to buy manures with.

Col. Shirley was next called out, and spoke briefly of the boys who were born and got their early training on the farm, and afterwards went out to occupy prominent positions in the cities. He thought the value of this kind of training under-estimated in reckoning the advantages of farm life.

This turned the discussion upon "Farmers' Boys," and Mr. Silas Holbrook made some good points on this subject. He believed that the reason why farmers' boys are better fitted for the duties of life than city boys is because they are kept at work, and he was inclined to think that we make a great mistake in trying to make boyhood easy, — a time when there is nothing to do but study books. Boys need employment, and the best education they can have is found in the practical experiences of life. Mr. Walker indorsed the idea that the most helpful education which a boy can have is to be had in doing farm work, and that among the other credits to be placed to farm life is good health.

Other short speeches were made by several gentlemen, occupying the time until four o'clock, when the meeting adjourned.

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MEETINGS AT PLAISTOW AND NORTH HAMPTON.

Two first-class meetings were held in these towns, though the traveling was bad and the weather very unfavorable. At the former place Mr. Humphrey made his interesting talk on corn-culture, showing his planter, and Mr. Sanborn spoke much as he has at other places, on implements and new methods of agriculture. Mr. DeMeritte talked on beet-culture and grass-cultivation. As these are all old topics, no intention is entertained of reporting them anew. In the evening the Secretary occupied considerable time in reminiscences of English farming. The attendance at Plaistow, notwithstanding the severe rain, was good, gentlemen coming in from neighboring towns, even from over the line, from Massachusetts, several practical farmers and gardeners taking part in the discussion. In the evening a glee club, of which the popular but now much-lamented Mrs. Nichols was a member, entertained the meeting. Had the weather been favorable, the efforts of Mr. Hills, the member from Rockingham County, who resides at Plaistow, would have been abundantly rewarded.

At North Hampton the meeting was a good one, and in the evening a large one. Only the county member and the Secretary were present. "Fruit-culture" was presented by Mr. Hills, and "The Way to make the Farm pay" by Mr. Adams. A rather critical friend from Portsmouth gives the accompanying note of the evening session: —

"Although the traveling was about as bad as it could possibly be on the day of the meeting by the Board of Agriculture, the attendance was very good, yet not what it should have been. There were many good farmers present, among whom we noticed Hon. Warren Brown, president of the state society, Hon. Emmons B. Philbrick, John F. French, Esq., Dea. Leavitt, J. W. F. Hobbs, Esq., and other prominent men. The meeting was opened by Mr. Hills of Plaistow, one of the Board, and his remarks were mainly to the effect that farmers should raise and put up the best of everything for market; that whatever they undertake to do, do it well. He gave a very interesting description of a dairy farm in the northern part of the State, where they make gilt-edged butter, no pains or expense being spared

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in building or appliances, — every animal being of pure blood, and having a separate stall, with clean straw to her knees, the dairy room being finished in hard pine and chestnut, with marble slabs, etc., — which is all very fine, but on being asked by Mr. Warren Brown how long the farm would run itself, although they sell the butter for seventy-five cents per pound, he could not seem to give a satisfactory answer.

"Mr. Hills next spoke of the apple crop as the best money crop for the farmer of this State, and said those who had taken care of their trees, by judicious pruning and manuring, were this year reaping the benefit of their labor — all of which can be taken with exceptions. That we had a large crop for the 'off year,' is certain; but it is just as sure that many who take the best care of their orchards, had no apples, and that in many orchards in this vicinity, one-half the trees bore a full crop, while the other half would not have an apple! Mr. Hills then spoke of other crops, advising the use of only the best seeds, thorough tillage, and raising the crop which would bring most money with least expense.

"He was followed by Mr. John F. French, who said we all knew how to raise milk, corn, potatoes, grass, fruit; what we wanted of the Board was to tell how by the expense of ninety cents we could succeed in getting a dollar, — a very small margin, — but which information we failed to receive, as they could not solve the problem.

"Mr. James O. Adams, of the Board, closed with general remarks on the good things being done throughout the State, and made a very interesting talk on fertilizers and manures."

It should have been said that in reply to Mr. French's question, which was a very captious one, in manner at least, that the Secretary said the afternoon's talk gave an outline of the manner in which the problem could be solved.

The meeting was, on the whole, an excellent one, and the courtesy shown the members of the Board was marked, and the hospitality manifested seldom equaled.

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MEETING AT SUNCOOK.

A meeting of the farmers of the Suncook valley was held in Suncook village on Feb. 16. Moses Humphrey, the Chairman of the Board, in calling the meeting to order in the forenoon, alluded to its objects, and stated that one of the great benefits arising from these meetings, in addition to the information imparted, was an increase of interest in agriculture. The West was becoming a strong competitor with us in dairy matters, and more attention should be given these subjects.

The first topic for consideration was "Manures," and James O. Adams, the Secretary, was the first speaker. He said that a stalk of corn was found, upon analysis, to contain fourteen or fifteen different elements, in common with other vegetables, the most prominent being potash, phosphoric acid, nitrogen, and carbon, some of which come from the atmosphere, but largely pass through the soil to the plant. If these elements are not in an available condition for plant-food, they should be made so. Constant cropping of the soil makes a deficiency of the principal elements of plant-food that must be supplied by manure. Only one-tenth of the substance of fodder was made use of by animals, and the remainder was passed into the manure-heap, which must be the basis of fertilizers.

Many elements disappear from manure before it is applied, but the loss of nitrogen is much less than is generally supposed, and the strong odor arising from the manure-heap was not ammonia, but a gas occasioned by decomposition. Drenching is one of the greatest losses, carrying the elements beyond the reach of the roots; and to avoid this waste, all manure-piles should be covered.

He advocated applying manure to level land in the winter, and a Goffstown farmer had practiced this method of application to side-hills, with excellent results. Manure should be applied so that the roots of plants should take it up. Roots cannot go eight or ten inches for food, unless they have food to enable them to do it.

We are not able, with all our efforts, to obtain all the fertilizers from the farm, and commercial fertilizers must be resorted to, which contain all the ingredients of plant-food in an available

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condition, but only two or three of these elements are valuable, and the remainder are used to hold the good ones. The licensing of commercial-fertilizer manufacturers, and the analysis of each brand attached to the cask or bag containing it, protected the farmer from deception. Animal meal was a good fertilizer, and had recently been fed to stock with good results, as had blood.

Joseph B. Walker of Concord, from whom the farmers of New Hampshire receive much practical agricultural lore, in continuing the same subject, said this manure question was a great one, and plants are continually calling for fertilizers.

Aside from the two sources of manure found in the barn-cellar and at our markets, he thought the soil was another, whose importance was often overlooked. It had plant-food enough in it to last thousands of years, but it is not in a condition to be taken up by the plants, and a far-seeing overruler had so arranged it that it could be kept.

Ages ago it was found that plant-food in the soil was not made available as fast as needed, and summer-fallowing was resorted to to obviate that difficulty.

Culture is a source of manure. A fine soil allows the plant-food to become available more rapidly than a coarse one. The soil should be made porous to allow the fertilizing elements coming down with rain to easily enter it. Although superphosphates are not so lasting in their effects as barn-yard manure, they contain little foreign substance. Stable manure is not the most economical to use. The stable and tools are the main sources of manure, but commercial fertilizers should be called in to finish out.

In 1870 this State had one manure-producing animal to every four persons, and this proportion of animals must be increased to increase the main source of our fertilizers.

Muck was a valuable source; so are ashes. A farmer in Newmarket found that one hundred and fifty bushels of ashes contain as many fertilizing properties as ten cords of manure.

He had used lime from a tannery with excellent results, and thought farmers should go over their farms asking what should be done to promote plant-growth.

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In the afternoon, Mr. Humphrey discussed "Corn-growing," much as already reported elsewhere, and an earnest discussion followed, in which Messrs. Sanders, Cochran, Langmaid, and others participated. Mr. Walker spoke of the needs of farmers, under the head of the "Drift of Agriculture."

In the evening there was a large attendance, Gov. Head, and Messrs. Brown and Burrows of the council, being present, and making excellent addresses.

MEETINGS AT DURHAM AND ELSEWHERE.

One of the best meetings of the season was held at Durham, under the direction of Mr. DeMeritte, the member for the county of Strafford. The speakers were Messrs. Hills and Adams, who discussed fruits, manures, and, to considerable extent, seeds. The topics being such as have already been reported, need not be long considered here. The meeting was an earnest one, and the citizens showed the Board great hospitality. Mr. Drake says: —

The advertised meeting of the forenoon was considered impracticable, and was therefore not held. In the afternoon the well-attended meeting was called to order by Mr. Albert DeMeritte, the member of the Board of Agriculture from Strafford County, who introduced Mr. Joseph C. Bartlett, of Durham, as chairman.

Mr. William H. Hills of Plaistow gave a talk on "Vegetables." From his knowledge of the soil he thought that grass should be the main crop for farmers in that vicinity. The farmers are not willing to commence at the beginning and learn the method of raising a crop of sugar-beets, and for that reason he had doubts about their being successful in the cultivation of beets for sugar. To produce the greatest amount of sugar, the beets should be grown under ground and should not be large. If one is to make a specialty of raising vegetables, he must go slowly at first to learn the proper method of cultivation from those who have been successful in the business. Onions cannot be grown in a light, sandy soil, but cabbages and carrots can. Crops must be adapted to the soil, and on soils suited to their growth onions are profitable. For successful cultivation of roots the

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ground must be made fertile and fine. Onions, having but few roots, thrive best when heavily fertilized and continually grown on the same plot. They should be sown early, cultivated carefully, and when the tops begin to wilt the maggot should be dug out immediately. Deep planting and banking up the tops, or the odor from gas-water applied near the plants, has kept the maggots from damaging the crop. There is a demand for carrots by Boston stable-keepers, and he thought them a valuable crop. The Improved Danvers is the best variety. Subsoiling has had its day. But few of the vegetables could be marketed well, except the potato. To shorten the battle with the Colorado beetle, he advised the cultivation of the early varieties of potatoes. Sprouting the tubers will shorten the period of cultivation. Within his remembrance, not five varieties which had been introduced at high prices were known now. The Early Vermont he considered better than the Early Rose. After cooking potatoes by boiling, he advised letting them steam a short time in the kettle after taking out the water. He plants pieces containing three eyes one foot apart in drills. Harvests as soon as ripe, and puts a bushel of gypsum on the top of each pile to prevent decay in the cellar. Aside from the time of germination, he found no difficulty in using the several parts of the tuber for seed. In times of high prices would use small potatoes, but generally thought the best seed of anything should be used.

Mr. James O. Adams then gave a talk on "Seeds," in which he advised the use of only the best varieties, for the natural tendency is downward. Soil and climate have much influence. We should establish purity of varieties. Deformed turnips will produce seed that will grow large quantities of deformed roots. The per cent of sugar in beets can be changed by selections of the beets for growing seeds. Animals can be bred to purpose, and vegetables and grains can be changed similarly. Many varieties of seeds cannot be grown in this country. Dealers generally are not growers of seed. Would invariably order direct from seed-houses. Vines will mix. Potatoes do not. Beans will. Model collections of seeds are needed, to compare the new varieties with. He knew of one in New Haven, Conn., and another at Chapel Hill, N. C.

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Mr. Comings of Lee had definite experience that potatoes will mix, and had varieties which had. Some seeds bought at country stores are reliable, others not.

Mr. Hills was much interested in the adulteration of seeds. English plantain is a dangerous wild seed, and difficult to eradicate. Parties in New York desired to buy all seeds that could be sold at low prices. He spoke of his efforts last year to have a law passed relating to the sale of spurious seed, and his remarks were not very complimentary to "the gentleman from New London," who was chairman of the Committee on Agriculture. The Crookneck will not mix with the common varieties of squash. Bees cannot get into some flowers, and no hybridization can take place with such unless planted near together. He desired to procure a collection of seeds. They should not be excluded from the air. Cloth bags are better than paper ones.

Isaiah Edgerly knew beans would mix.

Mr. Hayes of Madbury had some difficulty in procuring good seed.

Frank Tuxbury had lost a hay-crop by poor seed, and hoped a seed law would be passed. Would give his assistance if elected to the Legislature.

Ephraim Jenkins said, by saving the best specimens from which to grow seed, and removing the poor stalks, seed could be grown that could be "sworn to." The improvement is unlimited.

Mr. Hills informed Mr. Thompson that sugar-beets are valuable for feeding to stock.

J. O. Adams added that they were equally as good as the table varieties. One farmer had fed them to hogs with excellent results.

Albert DeMeritte said that sugar-beets in France and Germany had been made to produce an increase of from eleven to thirteen per cent of sugar. If beets or other vegetables are to be raised, they should be grown for special objects. If the Maine sugar-beet industry is a failure, it will be the fault of the farmers. Some grew one hundred and forty dollars' worth of beets per acre, and others considered them worth more than five dollars per ton for feeding purposes. Root-culture has been

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neglected. It should hold a stronger place. He fed a car-load of sugar-beet pulp to nineteen cattle. Daily he gave them three feeds of barley-straw, two of four quarts each of pulp, and two of hay, with good results, and his cows never did better. Pulp will enable farmers to feed out their poor hay to advantage. We must raise those crops which can be fed on the farm, thereby increasing the manure-heap, which is essential in our farming. Commercial fertilizers must be used to finish out.

In reply to the inquiry of David A. Stevens, Mr. Adams said that foul weeds could be exterminated by pulling, and many by cutting, before the seed formed.

Mr. DeMeritte had known of white-weed being smothered on land of Moses D. Page of Dover, by plowing. He would plow often and manure heavily.

In the evening Mr. Adams and Mr. Hills were the principal speakers.

Members of the Board have held meetings in connection with other organizations, and have as usual united with all associations for the promotion of the work.

At Enfield Center, Messrs. Humphrey, Sanborn, and Adams, accompanied by Prof. Blanpied, met with the grange and held a first-class meeting, the subjects presented being such as have been already named.

Messrs. Goodell and Adams met with the Piscataquog Valley Society at Goffstown, and aided in conducting the meetings.

Mr. Sanborn has attended many of the Vermont meetings, and taken an active part in their management.

The Secretary attended the annual meeting of the Vermont Dairymen's Association at Brandon.

Messrs. Humphrey and Goodell were delegated to attend the meeting in New York which resulted in forming the United States Agricultural Association.

Prof. Collier, of the Department of Agriculture at Washington, was secured by the Board to give a lecture on sugar-cane, corn-stalks, etc., for sugar, which he did before a small audience at Manchester. The address is given in this report.

The Board also took the lead in managing a few meetings in the state-house in June, 1879, at which John M. Shirley of

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Andover gave his excellent lecture on farm laws, and Dr. Boynton, the geologist, made interesting and valuable remarks on soils and their improvement.

Members of the Board attended many of the fairs of the State, generally taking an active part in adding interest to such occasions.

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ESSAYS AND OTHER PAPERS,

PRESENTED AT

MEETINGS OF THE BOARD.

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THE ART OF SELECTING STOCK,

BY THE ESCUTCHEON, THE SKIN, AND THE HAIR.

BY WILLIS P. HAZARD, OF WESTCHESTER, PENN.,

SECRETARY OF THE PENNSYLVANIA GUENON COMMISSION.

THE art of selecting stock to yield profit is one that is not as often thoroughly studied by farmers as it should be. Cattle are the most important of his tools of trade, and they will yield profit just in proportion as they are well selected. Almost every one has his own way of choosing an animal from a herd, and with the greatest care he will, more or less often, get hold of an animal that is no profit to him. This may arise from *lack of quantity* in her yield, or of *quality* in what she does give, or that she *will not milk long* enough. Now, any owner of cows will see those are the three points he most desires to have in the cows of his herd.

Then there are other points to be gained, almost as important, of which one is to know which calf to raise to make a profitable cow or to prove to be a good bull, or which calf to sell to the butcher. However able he may be to select a good cow, on this one point his judgment is most likely to be fallible. For all breeders know, that like does not always produce like, and that the effects of certain crosses are very likely to disappoint him; and after going to the expense of raising stock to maturity, he finds the labor and cost thrown away upon an animal he would not buy if it stood before him in a herd.

Could there be found out a system which would point out

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these defects in the character of the animal he was about to raise, early in its life, and thus save the time, labor, and cost of raising such an animal to its maturity; or, on the other hand, when such a mature animal was offered to him to be purchased, to point out its defects then, and thus prevent his investment in unprofitable stock, — if such a system could be made, and so clearly stated that it could readily be learned by the farmer, would such a system be of much value to him? Let those who have suffered, and still suffer, an annual loss of from twenty-five to thirty-three per cent, answer. And yet there are many who would not eagerly answer, because they do not know the loss they are constantly making by keeping unprofitable stock on their farms; for how many can say they have *tested thoroughly* their cattle, and *know* their contribution to, or diminishing of, his purse?

However, to these and to every class of farmers we say, it is important to know just what you have, just what you are about to purchase, and just what you are raising. We say, also, there is a system by which we can go into any herd and pick out the best cows, the medium cows, and the worthless animals, and that it can be done on any animal in two minutes, in less time than the auctioneer takes to cry their sale. We can tell by this system how many quarts of milk any cow will give, how many pounds of butter her milk will make, and how long she will milk after calving. And we can look at her calf and ascertain whether it will be a profitable one to keep, or whether it should go to the butcher. Also, an inspection of the bull will tell whether his get will be good dairy cows.

THE NEW MODE.

These points of information are truly ascertained by an examination of the escutcheon, the hair, and the skin of the animal. One of the merits of this system is, that it does not supersede any farmer's favorite mode of judging of stock; on the contrary, it supplements and assists him, and adds several new points to judge by: but our experience is, that when he learns the merits of the system, he will rely much more upon these rules than he will upon those he has heretofore practiced. But our advice is, to acquire a thorough knowledge of all the

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so-called mysteries of it, and by using them with his own rules he will seldom or never go wrong in his purchases. The escutcheon mode of selection is now becoming so universally known and practiced, no farmer can afford to be ignorant of it any longer; for there are so many now who practice it, that they will buy the best cows and leave him the poorest!

This system of judging cows is called the Guenon system, from the name of the inventor. Francis Guenon was a herdsman in France, a man of great judgment and penetration. He noticed upon the posteriors of cows that part of the hair grew contrary to the remainder of the hair on the animal, and that it assumed different shapes. After many years of experiment, practice, and testing, he brought his ideas into shape, and finally published the results, and was rewarded by many agricultural societies, and by the government with a pension for life of three thousand francs. His work was translated in this country and had a large sale. After some years of extended practice with it, Guenon re-arranged the whole system, enlarged the number of classes, decreased the number of orders, simplified it in every way, and added most important information about bulls; thus entirely superseding his former work, which should be thrown aside by every one who has that issue of it. The new work of Guenon we have translated, enlarged, and so simplified it as to make acquiring the system perfectly easy. Guenon's new engravings show just exactly what to look for; and when similar escutcheons are seen on the cow, the book will tell exactly what she will do. Also, one of the most valuable parts of the system is clearly defined; that is, how to avoid buying the bastard cows, or those which when pregnant begin to fail rapidly in their milk and go dry too soon to be profitable.

We will now give the general outlines and points, so that no one can remain ignorant of it in a general way, merely premising that for practicing it profitably it needs the learner shall, with book in hand, go into the barn-yard, place the cow in the class and order to which she belongs, as the engravings will point out, and then compare *what you know she does* with what the book or escutcheon calls for; and if they do not agree perfectly, carefully re-examine the escutcheon, the quality of the

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hair, and the color and texture of the skin, make allowances for or against her on account of her size, her age, and her condition as to calving, and you will be all the time learning, getting practice and confidence, and can then go outside of your own barn-yard and apply the rules safely on any animal.

M. GUENON'S SYSTEM

is based upon the discovery that on the posteriors of the bovine race, reaching from the vulva and extending down over the udder, and on the inside of the thighs, a portion of the hair grew upwards, and was easily distinguished from the surrounding hair growing downwards. In doing so, the upward hair takes different shapes, which he called the escutcheons. The size and shape of these indicate *the quantity* of milk the cow will give and *the length of time* she will continue to milk after calving. This latter was also affected by certain tufts of coarse hair, or blemishes on the escutcheon. Then he noticed the character of the hair growing upon the escutcheon, the color of the skin under it, and the quality of the skin. To be first-class, the hair should be short, soft, downy, furry, and the skin soft like a fine kid glove, and oleaginous to the hand, from the presence of the dandruff; and the nearer the color comes to a copperish hue, which he calls "indienne," or "nankeen," the better it is.

The hue and the skin of the escutcheon indicate *the quality* of the yield. He thus founded a system by which can be told, more surely than by any other methods, the quantity, the quality, and the time or yield of any cow. These rules are as applicable to calves and bulls; for by them can be told whether it will pay to raise a calf or to dispose of it, and whether a bull is likely to "get" milking progeny. In certain points the system is infallible, and in others it may so depend upon the judgment of the practicer as to make the system appear at fault. The infallible point is, that a cow having a first-class escutcheon, with soft, oleaginous skin on it, and with short, fine hair, is invariably a first-class cow in every respect. And just so much as she varies from that class, just so much are the quantity and quality of her yield affected.

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THE SYSTEM SIMPLIFIED.

Guenon arranged the escutcheon into ten classes, and these again into six orders to each class, which makes sixty escutcheons or different shapes to acquire a knowledge of; there are also ten "bastard" escutcheons, so that, without those of bulls, there are seventy escutcheons to learn. Now, as it would be poor policy to buy or raise a cow of the sixth order of the tenth class, it is not necessary to be acquainted with escutcheons of such low orders. Therefore the system may be very much simplified by paying no attention to any cows bearing escutcheons below the third order of all the classes. This would at once reduce the number to forty, — the ten classes of three orders each, and the ten bastard escutcheons. For when a cow does not carry an escutcheon within the third order of any class, it is best generally to pass her by.

THE ESCUTCHEON

is that surface of the udder, perinæum, and the thighs, where the hair grows upward. It may extend broad upon the thighs and upward even to the vulva, or may not; but, in any case, the broader it extends upon the thighs, the lower down and higher up the broad part covers, and the higher up and the broader the vertical portions are, and the more perfect and equal or uniform in the shape of its class it is, the better the escutcheon will be. By looking at the engravings, you will see the escutcheon looks something like a round-pointed shovel; the *lower half*, which we call the *thigh* escutcheon, representing the shovel part, and the *upper half*, which we call the *vertical* escutcheon, being more like the handle of the shovel. The lower half or broad portion of the escutcheon is of nearly similar shape in all the classes, only in the lower classes it is not quite so broad nor quite so high up as in the better classes; while the vertical portions gradually diminish both in height and breadth until in the tenth class there is none at all. Now, remembering this fact, that the vertical or upper portions are what mostly distinguish the different escutcheons, that will show most attention to be paid to the vertical part. Also it is about the upper part the blemishes usually appear which detract from the value of the escutcheon. The

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lower part of the escutcheon indicates the *quantity* of milk the cow will give; the *upper* portion *the time* she will milk; and the *color of the skin*, the feel of it, and the character of *the hair* on the escutcheon, will tell the *quality* of the milk.

Now these three points must be judged partly also by two other matters, the size and breed of the cow. It would be absurd to judge the large Durham from the same stand-point as the little Jersey, though both might have first-class escutcheons. For the quantity, the escutcheon would give twenty-four quarts to the one, and sixteen quarts to the other; while in quality, it would probably be second class in the one and first class in the other. Guenon was so strenuous on this point that he graded his estimates for three sizes of cows, the high, the medium, and the low. And your own observation will show the skin of the Jersey to be usually of a more greasy feel, and the hair to be much shorter and softer than those of the Durham. We don't enter into the nice distinctions between the three sizes of cows, because it only confuses, and it is not necessary, as our cows vary so comparatively little. And some knowledge of the yield of the different breeds and their qualities of milk will enable one to define very accurately, not only the yield, but the quality, according to any escutcheon under consideration.

THE DIFFERENT CLASSES.

The classes, as we have said, are ten, and Guenon named them by arbitrary names, which have no peculiar significance to us.

The first class is "The Flanders," because it was on cows of the Flemish breed he found more of this shape of escutcheon; and as they were the best cows, he called this after them, from the country whence they came.

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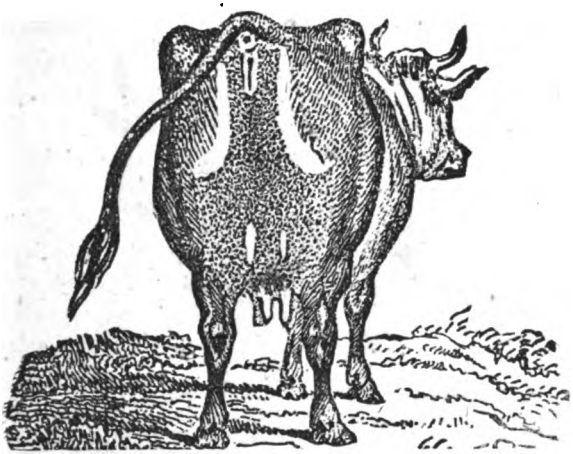

FIG. 1.

First order give 20 quarts and milk 9 months.
Second order give 18 quarts and milk 8 months.
Third order give 16 quarts and milk 6 months.

The second class he calls "The Left Flanders," because the escutcheon was more marked to the left of the vulva than to the right.

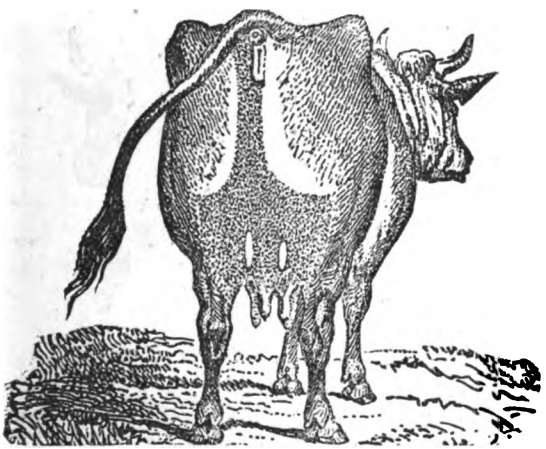

FIG. 2.

First order give 18 quarts and milk 8 months.
Second order give 16 quarts and milk 7 months.
Third order give 14 quarts and milk 6 months.

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The third class is "The Selvage."

FIG. 3.

First order give 19 quarts and milk 8 months.
Second order give 17 quarts and milk 7 months.
Third order give 15 quarts and milk 6 months.

The fourth class is "The Curveline," from the rounded double curve line in the vertical portion.

FIG. 4.

First order give 19 quarts and milk 8 months.
Second order give 17 quarts and milk 7 months.
Third order give 15 quarts and milk 6 months.

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The fifth class is "The Bicorn," from the appearance of two horns or projections in the vertical portion.

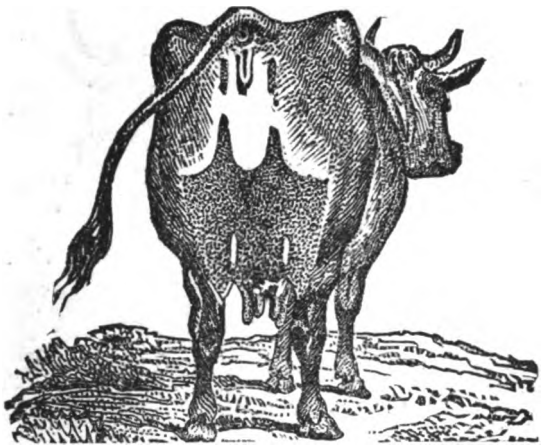

FIG. 5.

First order give 17 quarts and milk 8 months.
Second order give 15 quarts and milk 7 months.
Third order give 13 quarts and milk 6 months.

The sixth class is "The Double Selvage."

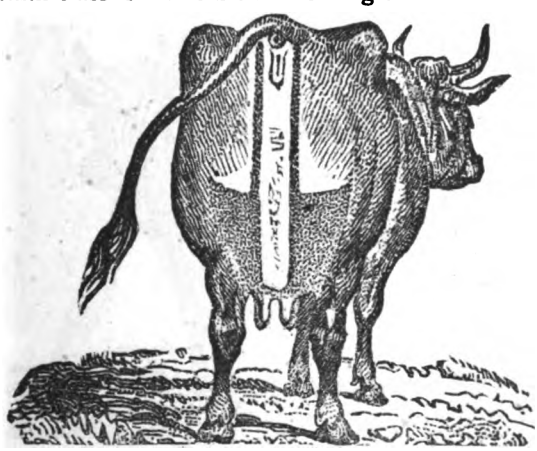

FIG. 6.

First order give 18 quarts and milk 8 months.
Second order give 16 quarts and milk 7 months.
Third order give 14 quarts and milk 6 months.

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The seventh class is "The Demijohn," from a resemblance to a five-gallon demijohn.

FIG. 7.

First order give 17 quarts and milk 8 months.
Second order give 15 quarts and milk 7 months.
Third order give 13 quarts and milk 6 months.

The eighth class is "The Square Escutcheon," from a fancied resemblance to a carpenter's square in the upper portion.

FIG. 8.

First order give 17 quarts and milk 8 months.
Second order give 15 quarts and milk 7 months.
Third order give 13 quarts and milk 6 months.

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The ninth class, "The Limousine," as this shaped escutcheon was seen on more cows of the breed from that district than on any other.

FIG. 9.

First order give 15 quarts and milk 8 months.
Second order give 13 quarts and milk 7 months.
Third order give 10 quarts and milk 6 months.

The tenth class, "The Horizontal," from the straight line at the upper edge of the thigh escutcheon.

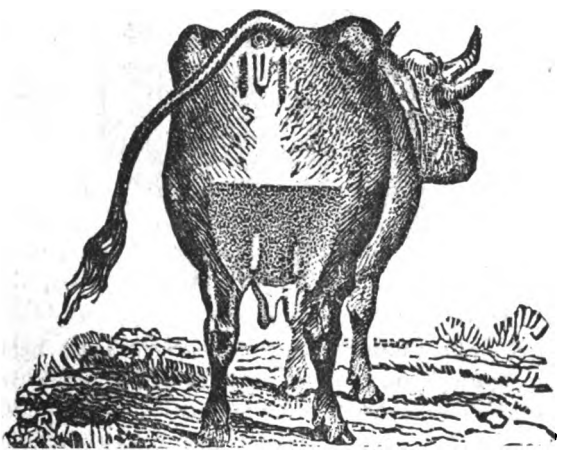

FIG. 10.

First order give 13 quarts and milk 8 months.

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Second order give 10 quarts and milk 7 months.
Third order give 8 quarts and milk 6 months.

Sometimes it is a little difficult to place the escutcheon readily in any certain class or order; this is one of the difficulties of the system. It arises from the parents having had different classes of escutcheon. For instance, the bull may have had the most common one on bulls, the Curveline, and the cow a Selvage escutcheon; and instead of the calf having either one strongly defined, the two will be mixed. A little more careful examination than usual will show that most probably one of the classes predominates, and then we estimate it as belonging to that most conspicuous class.

BASTARD ESCUTCHEONS.

There are some cows, which, though well marked, begin to fail in their milk as soon as they are with calf again. Some will fail very rapidly, others more slowly. They generally are marked first class, and on the handsomest cows. They are to

FIG. 11.

be looked for carefully, as they often mislead the best judges. They are distinguished in the first or Flanders class by an oval in the vertical escutcheon, or by the hair on the edges of the vertical escutcheon, where it meets the down-running hair, having a coarse, bristly nature and interlocking with a feathery

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appearance. All the other classes have two large ovals of coarse hair, one on each side of the vulva; the larger and coarser, the sooner they fail.

HOW TO LEARN THE SYSTEM.

If the learner will remember always that the first class is better than the second class, and the second class better than the third class, and so on down to the end of the classes, he will have gained the first step in acquiring the system. Then the next point to remember is similar; that is, that the first order of every class is better than the second order of that class, and so on down the scale of the orders until the sixth. Then he must learn the different shapes; first, the characteristic shape of each class as represented by the first order of that class, and connect with this in his mind the number of quarts a first-class cow in good feed and condition should give, as represented by that escutcheon, in her full flow of milk. Then he can next learn the variations in size and shape from this pattern escutcheon, and that will enable him to tell which order of her class to put her in, and that will then inform him what quantity of milk she will give and how long she will give it when with calf. It is not necessary to learn the orders farther down the scale than the third or the fourth. Next learn the distinguishing marks of the bastard or spurious cows.

HOW TO PROFIT BY THE SYSTEM.

Now, all this knowledge, to put it into profit practically, must be supplemented by the careful examination of the hair and the skin of the escutcheon and the udder. The shorter and softer the hair and the more oily and soft the skin, the better it is, for it indicates better quality. If the hair is long, harsh, bristly or wiry, particularly on the back of the udder, it indicates poor milk and a shortening of the time. The nearer approach the hair and skin are to that of a first-class Jersey or Guernsey, the nearer it comes to first class.

There is one point more in judging the escutcheon, and that is its size and position and uniformity; the higher up and the broader it is on the thighs, and with both sides exactly alike, the

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better it is. If the thigh mirror is broad and high, therefore very large, it indicates a large flow of milk; and if the vertical mirror is broad and smooth, it indicates a prolonged flow of milk. If the thigh or lower portion of the escutcheon is narrow, the flow will be proportionally small; if the vertical or upper portion is narrow and irregular, it is unfavorable to a prolonged flow. Oftentimes it is difficult to exactly trace the outline of the escutcheon; this is more so in winter, and when the cow is dry. In winter, when the hair is long, the escutcheon may be felt by passing the back of the hand down it, so that the edge of the nails can just scrape it. When the cow is dry it is sometimes necessary to distend the udder with both hands to observe the outlines, or the ovals on the udder.

GOOD SIGNS.

There is nearly always a sign accompanying a good escutcheon, and that is one or two ovals just above the hind teats, on which a fine coat of hair grows downward. These may be large or small, may be one or two, and may be alike or unlike in size, but they are always good signs. Two are better than one, and the larger and more uniform they are, the better; and the finer and softer the hair on them, the better the indications. No escutcheon is first class if it has not both or one, and of good size. They are generally easily perceived by a white and more shiny appearance of the hair on them.

There is still another very unfailing good mark, though it is not mentioned by Guenon, and that is what the Pennsylvania commission denominate thigh ovals. It is where the vertical loses itself in the thigh escutcheon. Here the down-running hair makes a semi-circular dip into the broad escutcheon. If this is of fine, soft hair it is an excellent sign, and the commission put great faith in it. My own cow, a Jersey, has these thigh ovals so large they extend down uniformly on each half of the udder and embrace the lower ovals on the udder. She is a first-class cow.

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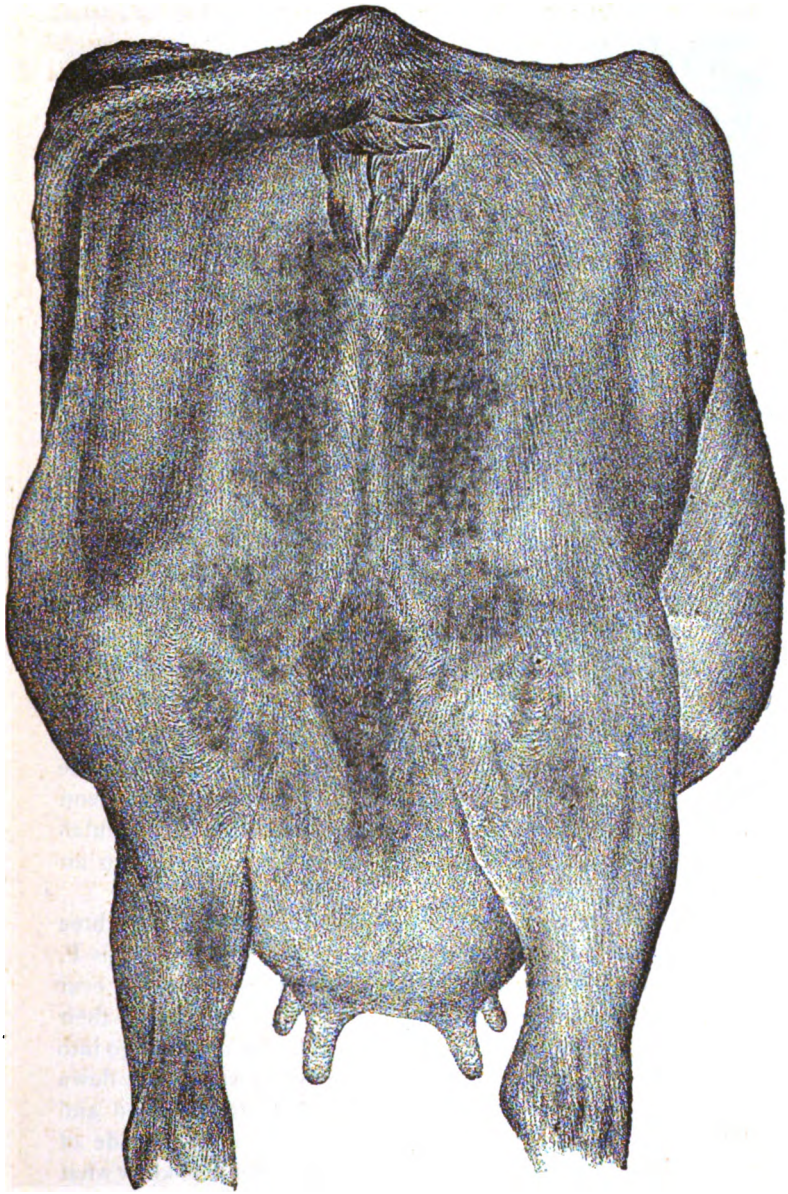

ESCUTCHEON OF "ROSIE," THOROUGH-BRED JERSEY COW BELONGING TO WILLIS P. HAZARD.

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BULLS.

Bulls have also escutcheons very similar to those on cows. These show the amount of their vigor, and the larger and better class the escutcheon is the better marked cows they will get. But it is important also to examine the quality and coloring of the skin, and the fine quality of their hair. Only bulls having these three points largely developed should be used, as they will

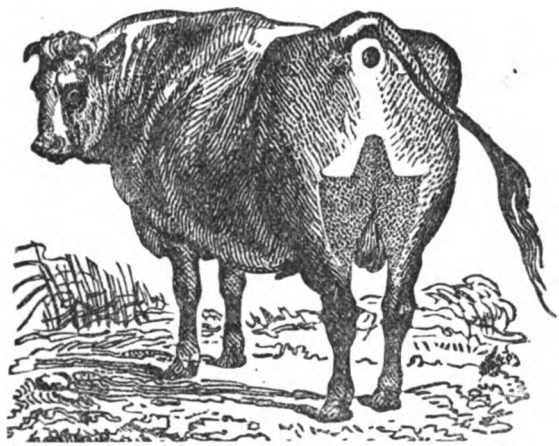

FIG. 12.

stamp their progeny, and, as they get so many yearly while the cow gets but one, it is the more important the bull should be first class. Bulls are more marked with Curveline escutcheon than any other class; next the Limousine, then the Horizontal. We must never expect them to have so broad or so high up an escutcheon as cows have.

The State of Pennsylvania appointed a commission of three experts, Messrs. George Blight, Chalkley Harvey, and Willis P. Hazard, to test the Guenon system, and they examined over two hundred cows and bulls, and made a report showing by their examinations the value of the system. Their plan was to go into the barn-yard, examine an animal, the secretary would write down his report, and when the whole herd had been examined and reports of all made out, they would be copied out alongside of the report of the owner for comparison. Neither side knew what

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reports the other side made until so copied for publication, thus ensuring a fair and honest statement from both parties. Seven of the cows were *blanketed* so that *only the escutcheon could be seen*, and the commission's account of them almost invariably in all three points tallied correctly with the owner's report. This report of the commission is published in "How to Select Cows, or the Guenon System Simplified and Explained, by Willis P. Hazard, Westchester, Penn.. Illustrated with 100 Engravings." Our experience on the commission showed there was a great desire to have an accurate account of Guenon's system, as well as to know and compare the accounts of the commission's reports. We have, therefore, prepared the work in an octavo volume, which is sent by mail free to any one remitting fifty cents in stamps or currency for it.

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FARM LAWS IN NEW HAMPSHIRE.

BY JOHN M. SHIRLEY, OF ANDOVER.

LAW is universal. Like the air we breathe, it pervades everything Neither mind nor matter can exist without it. Everything is held in subordination to some law. We can turn our backs on property, home, and country, but we can neither run away from death, the Deity, or the law. Your grandfathers put this in fewer words when they uttered the old-time proverb, "We can't get rid of death and rates."

Paul said: "Know ye not, brethren (for I speak to them that know the law), how that the law hath dominion over a man as long as he liveth?" And to no class is this more applicable than to the farming community. They own the real estate, as they term it, and to a certain extent they must partake of its fixity. The old proverb is that "A rolling stone gathers no moss." Paul may not have been a practical farmer, but by the old adage his words ought therefore to have the greater weight, for it is as true now as ever that "A prophet is not without honor save in his own land."

Paul, too, was reared in a region rough, broken, and hilly, but in which, in general, every spot of earth was made available, every hill was terraced to the top, and was what New Hampshire with ten thousand advantages which the Jews never had, never was, — a garden. Besides, he was one of the ablest and most learned of his time, brought up at the feet of one of the foremost of the great masters and teachers of the Jewish law, and, as the learned disciple, stood close to the Son of God. The principle

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which underlies his general proposition applies as forcibly to farmers as to any others. All exclusive, all allodial rights of property are artificial, not natural.

Bentham, one of the profoundest thinkers of his age, said that property was created by municipal law. Why? Because, before the existence of that law, there was no title to anything except the title which brute force gave; to wit, possession. The title of the robber was the best and the paramount title, because it was held by the law of the strongest, which was then the only test.

No class need the protection of the law more than the farming community. Why? Because their rights of property are created and upheld by the law, and because that property is open, visible, tangible, — rights in real estate, in flocks and herds, and the products of the soil, — unprotected from the hand of the spoiler, the thief, the burglar, the doer of malicious mischief, and from the firebrand of his enemy, save by the law. It should, therefore, be a part of every farmer's education to know that which concerns him so much. That education, like all others, must come to him in the great school of experience, from oral instruction, and from the books.

The agricultural interest in this State and nation is a gigantic one. Once there was practically no other. United, it could to-day control all others by the sheer weight of numbers, but relatively it has been weakening in power. Why? Because of lack of unity, lack of concert, and jealous clannishness, — in a word, because it has failed to keep step with the advancement of those other great interests, which, with it, make the common whole.

Whoever would succeed must keep up with the spirit of the age. The farming community must do it as well as all others. You are not exempt from the paramount law which governs all classes, any more than you can exist without breathing, where they cannot. There are some in almost every farming community, — thank God they are comparatively few, and day by day are growing less, — narrow, clannish, hepatized as to all public spirit, wedded to the spirit of darkness and of those who kindled the fires of Smithfield, who can hardly speak of the wonder-working inventor, the cultured man of letters, the successful mechanic, tradesman, and manufacturer, teachers, artists, and

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the other professions, without a shrug of the shoulders and a sneer on the lips. All this is unworthy of you.

The other classes cannot live without you, for they must have bread and the necessaries of life; you need them, for they are your customers, the banks upon which you draw at sight. A variety of interests begets a mutual benefit. You help them, and they help you; neither can get along properly without the other. Besides this there is an old adage, "It is a sorry bird that fouls its own nest."

From whom do all these classes come? More than three-fourths of them come from your own ranks. They sprang from your loins, they are your sons, and their wives are your daughters.

The first thing for a farmer to do is to get what is called a farm, *and a good one.* What can he get, and how must he get it? He cannot inherit from his father, take by will from his uncle, or buy from his neighbor, what they do not own. He cannot buy what they cannot sell, or accept what they cannot give. It is a common error that a man may own a farm absolutely, and do with it as he pleases. It has often been said in the mother country that the thatched cottage of the lowliest cotter is his castle, so secure that though the elements may enter every part of it, no man can do so, not even the king, unless by the owner's permission. This is a beautiful fiction, but none the less a fiction.

God owned the earth, for we are taught that He made it, and might do as He pleased with it. No man made it, and no man owns it or any part of it. At best he only owns a qualified property in it, a right to exercise "dominion" over some portion of it, and to use the same in such a reasonable manner as not to injure his neighbor. What he does own, he owns, in this way, from the middle of the earth below to the middle of the heavens above.

You may, as you term it, own a house. It may be your home with all that term implies, and be endeared to you by ten thousand associations; and yet it may be razed to the ground, blown up by powder, and every vestige of it otherwise destroyed, to prevent the spreading of a fire, the ravages of pestilence, or any

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other public calamity, or for the relief, protection, or safety of the many.

2 Kent's Com., 338.

Cooley's Constitutional Limitations, 526.

Russell *v.* New York, 2 Denio, 474.

And yet you have no constitutional right to a penny by way of compensation for what may have cost you a lifetime of labor. If any compensation is made, it must be by a legislative enactment, and you take it as the pauper does what may be doled out to him by the town, county, or state, not as a right, but as a gift, a charity.

So, too, you may have a choice garden or conservatory. The public highway adjoining thereto, whether bridge, rock, or earth, may be destroyed by fire, flood, or other action of the elements, and remain so for weeks, and the whole traveling public may convert either, so long as the necessity exists, into a public highway, and you have no redress in money or otherwise.

State *v.* Northumberland, 44 N. H., 632.

But this is not all. The field is broad. Further illustrations may afford food for reflection. One of the prime elements, and, in general, the substantial value of property, is the *use* of it, or the *right* to use it. If put in that precise form, few men who are sane and sober would wish to buy a farm with the fundamental proviso that they should have no right to use it, or no right to use it except at the will and pleasure of somebody else. The law abounds with what are termed "legal fictions." These fictions are the invention of courts. The judges invent them, as they say, to subserve the ends of justice. In a certain sense, they do evil that good may come. Under the guise of what is termed the "police power," you have your right to use your own property — all that is worth anything to you — limited, restrained, impaired, or destroyed.

Commonwealth *v.* Boston Beer Co., claimant, 115 Mass., 155.

Beer Co. *v.* Massachusetts, 97 U. S., 25.

And this power "extends to the protection of the lives, limbs, health, comfort, quiet of all persons, and the protection of all property within the State."

Cooley's Constitutional Limitations, 573–4.

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Under this you may not only be prohibited from using your own premises for the sale of spirituous liquors, or keeping them for sale, though no sales were ever in fact made, but for knowingly leasing, or even suffering them to be used, for these and a great variety of other purposes.

General Laws, 271, sect. 34.

State *v.* Shanahan, 54 N. H., 437.

And you cannot even recover for the rent of such premises, nor can a boy, who is hired for general work in and about such premises, recover for his services if he understood what business was there carried on.

So, too, such liquors, if impure, may be destroyed, — confiscated to the State, — at the instance of some individual who will institute proceedings therefor, and, if pure, may be sold.

So, too, you may be prohibited from using or suffering your premises to be used for the sale or storage of certain drugs, gunpowder, dualine, oils, giant powder, and a great variety of other substances, and for the keeping and exhibition of stallions in public places.

Cooley's Constitutional Limitations, 595–6.

But the power is not limited to such cases. Your beasts may be prohibited from running at large under the penalty of seizure and sale, and may be slaughtered by the proper authorities, to guard against pestilence and the like.

Cooley's Constitutional Limitations, 588.

Your hogs are your property. You may kill them for the market, for food, or for any other legitimate purpose, but you must slaughter them in a reasonable and proper manner. You may "stick" them, as it is called, but you may not scald them to death.

Dogs are the subject of property, but they may be shot by any one, whether engaged in mischief or not, if found at large without a collar about their necks, with the owner's name inscribed thereon.

General Laws, 280, sect. 7.

Morey *v.* Brown, 42 N. H., 373.

If you shoot your neighbor's dog you may remove him out of the way in a proper manner, but you must not skin him, take

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away any portion of his carcass, or in any wise convert the same to your own use, for if you do you will be liable.

You may be prohibited from erecting dwelling-houses or any other buildings in certain localities, or of certain materials, and you may lose your wooden house if you are unable to erect within the fire limits one of brick, stone, iron, or other specified material.

So, too, you may be prohibited from the removal of stones, gravel, or sand, and depositing the same in prohibited places.

Your mill-dams may be treated as a common nuisance, and their continuance as a crime. They may be blown up, torn down, or destroyed. Your places of burial may be closed or obliterated.

These laws are not always enforced, but they may be. The objection to this power is that any enemy, or people carried away by some public excitement, may put this dangerous machinery in motion. In the days of the "penal code" in that country from which so many of our ancestors came, the simple exercise of religion in one's own house was made a crime.

Barringer's Rise and Fall of the Irish Nation.

And even in New Hampshire, in March, 1878, it was decided that it was a crime for a man to sell cakes and pies in a peaceable and orderly manner, on his own premises, within two miles of a public assembly convened for religious worship, unless he first got the consent of the managers of such assembly, and though the sale was neither to the disturbance of that assembly nor such worship.

State *v.* Cate, 58 N. H., 240.

This decision was less the fault of the court than of the lawmakers. It went upon the ground that the legislature had the power to make such a law, and that the power had practically no limits. If this view be well founded, the legislature has the same power to prohibit any one from doing the same thing anywhere within the limits of the State. There is no essential difference in this respect between religious and other assemblies. If this rule can be applied in the case of one, it may be to that of others, for political gatherings and social assemblies are as much under the protection of the constitution as any other. It

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has not yet been decided whether or not it is a crime, or may be made such, to give away water within "two miles of such assemblies."

As you phrase it, you own a farm. A mill-stream runs through it. You may take, day by day, a reasonable quantity of the water for your stock, and the like, and for household purposes, but you must smart in damages if you divert a substantial portion of this running water to your trout-ponds, your reservoirs, your cranberry-meadows, your rice-swamps, or to irrigate your sand-patches and alkali lands, or for any other purposes.

Cowles *v.* Kidder, 24 N. H., 378–9.

Hayes *v.* Waldron, 44 N. H., 584–6.

True, you may, in a reasonable manner, use any stream which your land touches for washing sheep, crossing it with teams, and allowing cattle and swine to traverse it.

Hayes *v.* Waldron, 44 N. H., 585.

And so, in the absence of special statutes upon that point, you may, if it be a reasonable thing, under all the circumstances of the case, in general, throw into the stream, saw-dust, tan-bark, shavings, soap lees, and other impurities, the waste of grist or fulling mills, cotton and woolen factories, and the like; but in general such a use is held to be unreasonable where your mill is on a stream which is used for some purposes of manufacturing where pure waters are required, or where the stream is treated as a reservoir, or used for aqueduct purposes for a large number of people, like the Croton. Under these circumstances you cannot, in general, pollute the waters in this way without being guilty of maintaining a nuisance and becoming responsible in damages to those who are injured thereby.

Hayes *v.* Waldron, 44 N. H., 585.

In a word, you have an equal right in a stream with your neighbors, but cannot so use it as to deprive them of, or impair, their equal right.

So if you turn a stream into your mill-pond, which does not naturally flow into it, you are liable both to the owners below and to those through whose land it formerly flowed, for the damages.

Tillotson *v.* Smith, 32 N. H., 94–5.

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If the stream runs through your land you may build a dam across it, but you are liable if you flow the land of those higher up on the stream, and if you withhold the water from those below; for the law is, "Every owner of land situate upon a stream, has a right to the natural flow of this stream; a right to insist that the stream shall continue to run *uti currere solebat* (as 'twas wont to run); that it shall flow upon his land in its usual quantity, at its natural place, and at its usual height, and that it shall flow off his land upon the land of his neighbor below in its accustomed place, and at its usual level."

Tillotson *v.* Smith, 32 N. H., 94-5.

But the limitation upon your right to use your own property does not stop here. You may live upon the Winnipesaukee or the Sunapee, or other lake outlets, like the ones to these bodies of water. If you do, and neither flow your neighbor above nor injure the land-owners below, you may still be indicted for erecting a dam or for maintaining it if the dam would of itself obstruct the passage of migratory fish from the lake to the sea or from the sea to the lake; and the fact that you had maintained such a dam for twenty or even a hundred years would be no defense.

State *v.* Franklin Falls Co., 49 N. H., 240.

In England, in Massachusetts, and in most of the States in this Union, the law is that the owner of land where it is found has the unqualified right to dispose of percolating or underground and surface water not gathered into streams as he pleases. There, one man by sinking shafts and wells may cut off entirely the source of the water supply of his neighbor, and drain his well, and there is no redress. There are, for illustration, two artesian wells in London connected with mammoth breweries. One is upon one side of the Thames and the other upon the other. Notwithstanding their distance from each other, they both draw from the same fountain, and are compelled to pump their supplies on alternate days; otherwise, neither could carry on its immense business. After a severe and protracted struggle, the law was adjudged otherwise in this State.

Bassett *v.* Salisbury Manufacturing Co., 43 N. H., 562.

Swett *v.* Cutts, 50 N. H., 439.

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Here you have the right to divert or obstruct the flow of water circulating through the pores of the earth, or spreading over the surface in the season of melting snows or heavy rains, if, under all the circumstances of the case, what you do was a reasonable use of your own land. The decision in Dr. Bassett's case was made upon exceptions to the ruling of the present chief-justice taken at the fifth trial, upon the weight of the English and American authorities, though contrary to his own judgment. The harshness and injustice of the English rule shocked the full bench, and the judges at last concurred unanimously in the opinion, drawn up by Mr. Justice Bartlett, which is a monument to that far-seeing and pure-minded judge.

Your neighbor may own on three sides of your farm, and his fruit-trees may line the whole length of the partition wall. The trees may draw an equal share of their sustenance from your soil, and yet you are liable in damages if you pluck an apple from the branches of these trees which overhang your land, or if you even pick up or eat one which has fallen on your side of the line.

Cooley on Torts, 567.

It is said, upon respectable authority, that the adjoining owner may come upon your land, in a reasonable manner, gather his fruit and take it away; while at most you can treat the overhanging branches as a nuisance, and only abate it by sawing or clipping them off in a reasonable and proper manner. But if these fruit-trees happen to stand on the line, you and your neighbor are tenants in common. Neither has the right to cut down or injure them, and each has an equal right to gather the fruit, particularly if he does this from his own side of the hedge.

Cooley on Torts, 567.

In these cases your property has been destroyed or its use been given to others, or you have been prohibited from using it, and yet have no redress for the injuries which have been heaped upon you, for the law awards you no compensation. But at its October term, 1876, the highest tribunal in the land — the supreme court of the United States — laid down a far more novel, startling, and extraordinary doctrine, to wit: that if you

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own real estate or other property, and devote it to a use in which the public has an interest, you thereby grant the public an interest in such use; and that so long as you so continue to use it, the legislature may prescribe the manner in which you may use it, and may cut down the compensation for the use of your own property to just such figures as they please.

The Granger Cases, 94 U. S., 113-87.

The court say, that "property does become clothed with a public interest when used in a manner to make it of public consequence and affect the community at large;" and instance, as illustrations, chimney-sweeps, cartmen, wagoners, carmen, bakers, owners of the banks of rivers, ferrymen, hackmen, inn-keepers, wharfingers, millers, auctioneers, common carriers, and the like. It is extremely difficult to see why this reasoning does not apply with equal force to ministers, saloon-keepers, doctors, sewing-machine and other peddlers, painters, printers, newspaper-men, truckmen, peanut-venders, milliners, and farmers. If it does, it is clear that the legislature can provide by law what pay all these classes shall receive for their services. This power is clearly asserted so far as chimney-sweeps and cartmen are concerned. So, if you come up to the standard of a chimney-sweep or a boot-black, the law-making power can prescribe that you shall have something, or a nominal nothing, for the use of your property, real and personal.

Your real estate, too, may be taken from you against your will, by virtue of what is called the power of eminent domain. This is another very solemn, but, as Judge Cooley says, "convenient" "fiction of the law." The theory, in plain English, is, that the king once, by "divine right" or "by conquest," owned all the real estate in the State, and that the Revolution put the state government in his shoes; that though no such thing was ever put in writing, mentioned, or suggested, that all the land was sold, or given away, by the government with the implied condition or reservation that the government could take it back again whenever it pleased, through some tribunal created by law for that purpose.

Our constitution secures us the right of acquiring, possessing, and protecting property. It also provides that it shall not be

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taken from us, "or applied to public uses, without our consent or that of the representative body of the people." By the constitution, it cannot be taken from us for private purposes at all; that is, the legislature has no power to take the land of A and give or sell it to B, or provide any instrumentality through which it may be done; but it may provide that A's property shall be taken from him and be resumed by the State upon payment therefor. The highwayman takes your property against your will without paying you for it. That is robbery, — a crime which brought Michael Martin to the gallows. The State takes your property from you against your will through formal proceedings, and provides that some tribunal shall say what you are to have for it, that you are to take the amount awarded or nothing, — and this is *eminent domain.* It differs from robbery simply in this, that you *may* have as compensation for your wrongs what some one else says you ought to take. In this way the State takes your land for highways, driftways, grade or toll roads, turnpikes, railways, and may for any other public use.

What is a public use? Obviously the phrase means precisely the same as the right of the public to use. Every one has the right to use a common highway in a proper manner. That is clearly a public use. A public mill where every one has the right to take his corn, grain, and the like, and to have it manufactured upon precisely the same terms as every other person, would occupy essentially the same position. When you get outside of such uses, you get outside of the constitution. This is the law as still held in Vermont and some other States. No legislature in this State ever dared to act upon the contrary doctrine until 1862, and no court before that time ever presumed or suggested that any man's property might be taken from him and be given to a starch-mill, a cotton or a woolen factory, or any other private institution or combination at a valuation fixed by some one aside from the owner.

In 1867, the supreme court of this State in effect decided that the land of A might be taken from him and given to B, whenever a commission appointed by a court, or a jury would say that such a change of property would be promotive "of general public utility;" in a word, where these tribunals would say

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that in their opinion it would be a good thing on the whole to take A's property away from him and sell it to B.

Great Falls Manufacturing Co. *v.* Fernald, 47 N. H., 444.

This is, in substance, saying that a man is a solemn tenant at will of his farm, and may remain so until three men can be found who will say under oath that it would be better on the whole for the community for some one else to own it. If this decision and those in the Granger cases are sound, it logically follows that any man's farm may be taken from him when any one needs it for any of the purposes set forth in the Granger cases, or where three men think that it would be for the best on the whole to have one man own the property rather than another. No man is in any danger who has nothing which any one wants. The perils to any man's possessions arise when some one else desires dominion over them. Thousands and tens of thousands of people have never been disturbed in their rights, because, as the great Scottish poet said, "No temptation."

The short of all this is, that no man in this State owns or ever can own a farm. He can only own the right to the use of one so long as he uses it in such a reasonable way as not to injure his neighbor; but he has not even this right if the authorities exercise their power to destroy it, or to take it from him, to deprive him of the use of it without compensation under the police power, or if the legislature fixes the terms upon which he may use the same, or if some tribunal orders it taken from him and given to some one else, upon the payment of such sum as that or some other tribunal may say he ought to take for it. When you get a farm you get this right and nothing more.

You may acquire a farm in four ways:—

1. By successful theft (lawyers call it prescription or adverse possession).
2. By inheritance.
3. By will or testament.
4. By purchase.

With an eye to the nature of property, let us examine them in their order. The Almighty created the earth. It was His then, not yours or mine. How came you or I by any right to it, or

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any portion of it? No man can show a title-deed from the great I AM. The good book, however, tells us that He gave to man "Dominion over all the earth, and over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth."

And the great commentator upon the laws of England says that all property rests upon this foundation; but this, as you will see, gave no man any exclusive property rights. It made him what lawyers term a tenant in common; that is, an equal owner with every other human being, and with no greater right than "the least of these." Every man had the same right, the same interest, and the same dominion over every spot of the earth's surface, and the living creatures thereon, that every other man had. In short, there was nothing which any one could justly call *exclusively* his own. The next step in the chain of title was for one man to exclude all others from the dominion over a particular "living thing" or a particular and definite tract or portion of the soil. This at first could only be done by the law of the strongest — by brute force. This title lasted just as long as the act of possession continued, and no longer. It might be only five minutes, and it might continue fifty years. When the first possessor abandoned it or died, the next comer took it with the same right as he.

The patriarchal system was the first form of government. The family was kept together, and when its head died the household took his possessions, — for he really owned nothing, — and stepped into his shoes. If he had no wife or child, his servants took their places.

The necessities of mankind, at a very early day, compelled traffic in kind, — the exchange of cattle, horses, goats, and other personal property. A common medium of exchange, money, shekels, or pieces of silver, was the creation of a later epoch. The earliest controversies of which we have any account, the first positive assertion of title to real estate, were as to who had the rightful possession of wells of water, pastures, fields, caves for the burial of the dead, and the like. The purchase of the cave of Machpelah by the patriarch Abraham for a "possession of a" burying-place, was one of the first, and probably the first,

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on record. The contract in that case was by word of mouth. It was consummated and the money paid on the spot. There was no deed or other instrument of conveyance, or witnesses as such. The change of possession was enough.

Trades of real and personal estate at that time stood upon the same basis. Neither reason nor instinct required that a conveyance of any title to either should be under seal, — which was all that was meant by the word deed, — or by a will under seal, or that there should be witnesses. These instruments became in time a matter of convenience, and were the artificial creation of the civil law, and have continued ever since. An oral bargain for the sale of real estate would be as good as any other if it were not for the express words of the statutes and the traditions of the law.

The theory of the law of adverse possession is this: If A stands by and sees B use his land, as if he were an owner, for a long period of time, without the assertion of his title, the law presumes he never had any because he has not asserted it, and that B had because he did assert it.

Such assertion may be by words, acts, or both. Formerly, eighty years' possession was necessary for a good title; then it was reduced to sixty, then to forty, and now to twenty. So if you go upon your neighbor's land and exercise dominion over it for twenty years, as owner, without interruption from him or those who stand in his shoes, you own it, and not he, — you have acquired the title by successful theft. There is a distinction, however, between such possession under color of title, and possession without it. For illustration: If A should give you a deed in proper form, of two hundred acres of land, and you should enter into possession of that tract under that deed, and should maintain adverse possession for twenty years or more, you would own the entire tract, though A had no title to it when he made the conveyance to you, and though the lines were never run out, the lands were never fenced or inclosed, and though in fact you never put to use more than a quarter of an acre of it.

Hale *v.* Glidden, 10 N. H., 401.

Little *v.* Downing, 37 N. H., 367.

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But if you enter without a deed, the law is otherwise. If you occupy it for twenty years adversely, you can only hold so much as you *in fact* occupy, either by inclosing it with a fence, or by plowing, cultivating, or putting it to a definite use in some other form, or, as the old law-books expressed it, what you actually used and marked with your feet. In the case I have put, the disseizor or adverse possessor would hold two hundred acres where he entered under the color of a worthless deed, but only a quarter of an acre where he entered without it.

Hale *v.* Glidden, 10 N. H., 401.

The law of inheritance in this State may be summarized in a sentence: When any person who is full twenty-one years of age dies, his real estate vests instantly in his heirs at law, subject to be recalled and sold so far as may be necessary to pay his debts and the expenses of administration.

The law of wills may be stated briefly. It was created subsequent to that of inheritance. Long after the right of property was recognized, it became the law that a person might by a solemn act transmit it or a portion of it to such persons as he might point out in this instrument. To this rule, only a few hundred years ago, there were marked exceptions in the mother country. No man could devise away the whole of his real estate, except by custom in certain localities. The oldest son had certain rights which no other child had. Our ancestors, when they came to the bleak shores of New England, rejected substantially the whole law of the mother country in relation to real estate; but even in this State they provided at an early day that the oldest son . . . might hold "a double" portion in certain cases.

Act of 1718.

To-day the husband cannot, by will, deprive his wife of dower or homestead in his real estate, nor her allowance for present support, nor of her distributive share therein, which is in general one-third of the estate after the payment of debts and expenses of administration, nor can he deprive any child, born or unborn, of his rights in the homestead or of his support up to the age of seven years; but, aside from this, he may in general dispose of all his property as he sees fit.

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In order to do this, he must, as the law says, at the time have a disposing mind and memory; that is, he must know what he is about when he does it. In the next place, he must use language that conveys the meaning that he wishes. His will must be under seal, signed by him, or by some person in his presence and by his express direction, or he must make his mark. It must now, and the law was substantially the same three centuries ago, be witnessed by three credible witnesses. These witnesses must sign their names to the will, in his presence, at his request, and in the presence of each other. The attesting witnesses to the will must be competent witnesses at the time they attested it. The executor named in the will and his wife are both competent attesting witnesses if they take no beneficial interest under it.

Stewart *v.* Harriman, 56 N. H., 25.

A will may be made and executed upon Sunday as well as upon any other day.

George *v.* George, 47 N. H., 27.

No judge of probate can make or draft any will for any person except himself, and all wills made or drawn by judges of probate since July 16, 1864, are void.

General Laws, 449, sect. 19.

The supreme court had decided in 1863, that, though the judge was prohibited from writing a will, the will itself was not in consequence void.

Moses *v.* Julian, 45 N. H., 52.

The statute cited was passed by the legislature to pull up that decision by the roots.

No person should witness a will who takes a beneficial devise or bequest under it, for the law provides that the will shall be worthless so far as respects that witness unless there are three other competent witnesses thereto.

General Laws, 455, sect. 8.

You all know that a bargain by word of mouth for the sale or purchase of a farm is good for nothing. Many, however, think that if the consideration money, or any part of it, is paid down by the purchaser, "it binds the bargain," so that he can compel the seller to give him a deed of the land or make him smart in

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damages. Few things are farther from the truth as a matter of law. Even if the bargain is reduced to writing, it is of no more account in law than a piece of white paper unless the agreement or some memorandum of it recites the name of the seller, the name of the purchaser, the consideration, with a definite and distinct description of the premises — such as would in general be sufficient to pass the property in a deed. It is not necessary that the seller should sign the agreement or memorandum, but, if it conforms in all other respects to the law, it is utterly worthless unless the purchaser either signs his name in person, or by some agent who has due authority for that purpose in writing.

Sherburne *v.* Shaw, 1 N. H., 157.

Grafton *v.* Cummings, 99 U. S., 100.

The last case cited was one recently decided in the supreme court of the United States. It involved ninety thousand dollars, besides enormous expenses in litigation. It was a suit brought by the representatives of the deceased owner of the famous Glen House at the White Mountains against the purchaser. The agreement was in writing; it set forth the consideration price, ninety thousand dollars. It contained a minute description of the property; it was actually signed by the purchaser in person; but the fatal defect was that it did not state who owned the property nor who was the seller, although the purchaser well knew it. The result was that the purchaser prevailed and the other party lost thirty thousand dollars besides the expenses of the litigation. Very few agreements of this kind are so framed as to be valid, and this is particularly so as respects auction sales of real estate, and more especially of the sale of the real estate of persons deceased.

When a man makes a bid at an auction sale he makes an offer. When the auctioneer knocks the property down to the highest bidder he accepts the offer, and that makes a bargain. It takes two to make a trade. The man who bids is one party. The man who sells is the other party. What either does by an agent he does himself, and the auctioneer being the agent of both parties for this purpose binds both; and this, though formerly doubted, is equally true of sales of real and personal estate.

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But all this is based upon the assumption that by the auction bills or otherwise the name of the seller, that of the auctioneer and his authority, a distinct description of the property to be sold, with the time and place of sale, are all properly set forth; and further, that the buyer's name, as such, is forthwith entered in the sale-book or upon the catalogue of the auctioneer. And the same rule applies to sheriffs and their deputies, administrators, or other officers acting under the authority or order of the courts. The great preponderance of authority is that the auctioneer's clerk has the same power as his master, the auctioneer, in entering the buyer's name in the sale-book.

Browne on the Statute of Frauds, 582-3.

Frequently when a man proposes to sell property at auction, he employs or has some friend of his employ a "secret puffer," or what is commonly called a "by-bidder." This is entirely illegal. No man who bids off goods at auction is bound to take them where by-bidders are so employed. The highest genuine bidder has the right to take the property at his bid, if he so elects, but the owner of the goods who employs by-bidders cannot compel him to do so, or make him pay damages if he refuses to do so.

Towle *v.* Leavitt, 23 N. H., 360.

Auctioneers not unfrequently "bid up," when they do not propose to take the goods; in a word, really act as by-bidders. The auctioneer is the agent of both parties, and is bound to act in good faith toward both, and by-bidding is an act of bad faith, reprehensible and illegal. But though courts of law never enforce these oral bargains, and can in general give no redress for their breach, courts of equity under some circumstances will; thus, if you bargain away your farm, and the purchaser in good faith goes into possession under that agreement, makes improvements thereon, and offers to or is ready to perform his part of the contract in all respects, a court of equity will compel you to convey the property to him.

Tilton *v.* Tilton, 9 N. H., 385.

Ham *v.* Goodrich, 33 N. H., 32.

And where a part of the land so bargained has been conveyed to him, — the price being entire, — and the whole consideration

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has been paid, the court will compel the conveyance of the residue.

Way *v.* Cutting, 17 N. H., 450.

So, too, if you sell your farm, and the buyer enters into possession under that bargain or with the agreement that he is to purchase it, if he neglects or refuses to take it and pay for it as he agrees, you may prosecute him in trespass for the damages, or recover of him for the use of it.

Alton *v.* Pickering, 9 N. H., 498.

But if you sell in this way your farm for five thousand dollars, and the purchaser pays all but one dollar, goes into possession under the purchase sale, and fails to pay the balance according to his agreement, you may keep the premises and the money too.

Ayer *v.* Hawkes, 11 N. H., 248.

Where, however, the contract is not carried out, that is, where the purchaser under such an agreement fails to pay when "neither was in fault more than the other," the seller may rescind the contract and recover the damages in trespass or the rent in assumpsit for the use of the premises at his election.

Woodbury *v.* Woodbury, 47 N. H., 11.

And if you agree orally to sell your farm and take your pay in labor, you are not bound, because the contract is not in writing, and the purchaser may recover of you for the labor he has actually performed.

Crawford *v.* Parsons, 18 N. H., 293.

In this State a deed or any other form of conveyance must be under seal, witnessed by two witnesses, and acknowledged before a magistrate before it is recorded in the registry of deeds. The deed must be made in accordance with the law of the State where the land is. Every deed should be recorded at once, as otherwise the buyer may find his farm taken from him by a subsequent purchaser from his grantors, or by their creditors, who had no actual notice of the existence of his deed.

You farmers complain, and in one sense justly, of the antiquated phraseology, the idle repetitions, and the formal words used in deeds. All lawyers know, that, aside from the description, nine-tenths of these phrases are useless. One reason why they were introduced at a very early day was that the scrivener

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wrote by the piece, — was in fact, as in name, a "penny-a-liner," — the more words he wrote the more pay he got. You ask why, in this age of progress, all this useless verbiage is not discarded. The answer is, that you will not have the change made, you will not patronize the men who would put your deeds in the simplest form. Some thirty years ago the late Chief-Justice Bell framed a brief but excellent form. It contained only what was necessary. The late G. Parker Lyon printed about four hundred of those blanks. With all his patience and industry he was only able to sell and give away about fifty blanks. The lawyers were ready to use them, but you, their customers, were afraid of them, and would not take deeds in that form; and as for the justices of the peace, who, in the country, make most of these instruments, Mr. Lyon told me that they would not touch one of these brief blanks at all. So Judge Bell lost his labor, Mr. Lyon lost his blanks and the money he paid for them, you lost a plain, clear, intelligible form of conveyance, and we all plod on in the same old way.

Most deeds purport to convey the land "with the buildings thereon." This clause relating to the buildings is a waste of words, adds nothing to the legal effect of the formal terms of conveyance, for the buildings, in the absence of special and restrictive terms, pass to the purchaser as land, — the same as the stones, fences, and growing trees, the fallen trees, the old floors in the tie-up, the stanchion-timbers, hinge-staples, and tie-chains.

Sawyer *v.* Twist, 26 N. H., 348.

Wadleigh *v.* Janvrin, 41 N. H., 503.

Glidden *v.* Bennett, 43 N. H., 307.

It is true that a dwelling-house, barn, and out-buildings may, under some circumstances, be personal property, and be sold and conveyed as such. If I hire a building-lot for the purpose of erecting thereon a building for fourteen years, or any other specified time, or if you give me a license to erect a building upon your land, the building is personal property; but presumptively buildings are real estate, and pass by deed or extent.

Mills *v.* Peirce, 2 N. H., 12.

Gibson *v.* Brockway, 8 N. H., 471.

Cutting *v.* Pike, 21 N. H., 352.

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So a deed of a house or a messuage, if executed by the owner of the land underneath the building, passes not only the house proper, but the necessary out-buildings, the cellar, the foundation, and so much of the soil as is necessary for the convenient use of the same, and may include the curtilage or yard, the orchard, and the garden spot used with it, "so that an acre or more may pass by the deed." This has been the law for more than two hundred years.

1 Coke upon Littleton, *B.* 5.
Carden *v.* Tuck, Cro. Eliz., 89.
Sheppard's Touchstone, 94.
Smith *v.* Martin, 3 Saund., 401, Note.
Doe *v.* Collins, 2 Term, 502.
Ginson *v.* Brockway, 8 N. H., 470.
Bennett *v.* Bittle, 4 Rawle, 339–42.
Marston *v.* Stickney, Grafton Co., March Term, 1879.

The trees, also, may be converted into personal property in two ways, — they may be cut or severed from the realty either by axes or by a piece of paper under seal called a deed. The paper alone will not cut trees, but with a seal, in the eye of the law, it will cut them just as well as a sharp ax. You see from this the great virtue and legal efficacy of a tiny wafer or bit of sealing-wax. If your deed conveys a definite tract of land but reserves to you the trees growing and standing thereon, or if you convey the trees only, excepting the land itself from the operation of the deed, the trees are constructively severed from the soil, as if they were cut with an ax, and thereby become personal property, and may be sold as such.

Kingsley *v.* Holbrook, 45 N. H., 313.
Hoit *v.* Stratton Mills, 54 N. H., 111.

No man should ever take a deed unless it contains a distinct description of the premises conveyed, with definite and fixed monuments.

Our deeds, as a rule, are framed carelessly. Those made in Egypt two thousand years ago were far in advance of ours at this day. I am not aware that there is any State in the Union where so much looseness exists in the matter of description in deeds as here. To make something out of nothing, or what is

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next to it, our courts have adopted the doctrine of "actual" or "practical" "location," the result of which, as once stated to me by an eminent Massachusetts lawyer, is the substitution in this State of conveyance by word of mouth, and by acts, for conveyance by a solemn instrument. The deed may be for a hundred acres; but the parties may locate, and then the court will construe the deed in the light of the acts of the parties after the deed was made, and in this way construe a deed of one hundred acres into a conveyance of ten acres.

The courts of Massachusetts are much more strict, and they may become so here. As a rule, our deeds say at best that the premises conveyed are bounded north, south, east, and west, by the farms of A, B, C, and D respectively. This may be all well enough as far as it goes, but it is indefinite, and law-suits are the result. Nothing is more important than a distinct "butting and bounding," to use the old phrase, — for they control points and distances, and the number of acres stated, even when no such waste words as "more or less" are used. For the quantity might pass a thousand, still the monuments must govern. It is true that this disparity might under some circumstances have a tendency to show fraud or mistake, for which a court of equity might reform the deed or set it aside, but while the deed stands, the monuments must control.

If a boundary line runs to a tree, rock, iron pin, stump, wall, fence, brook, stream, river, mill-pond, reservoir, natural or artificial pond in which there is a perceptible current, the farmer ordinarily owns to the center.

Bowman *v.* Farmer, 8 N. H., 402.
Peaslee *v.* Gee, 19 N. H., 273.
Kimball *v.* Schoff, 40 N. H., 190.
Boscawen *v.* Canterbury, 23 N. H., 189.
State *v.* Gilmanton, 14 N. H., 477.

And this is generally true in respect to highways.

Goodeno *v.* Hutchinson, 54 N. H., 159.

And it makes no difference if the land is bounded on the "side" of a certain highway, or upon the "easterly side of said road," and the like. The line goes to the center of the road.

Woodman *v.* Spencer, 54 N. H., 507.

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But a grant of land extending to and bounded upon a lake, or other large body of standing water, goes only to the edge of the water.

State *v.* Gilmanton, 9 N. H., 461.

Same Case, 19 N. H., 478.

When the proper authorities lay out a highway, they do not take your land, or even the trees upon it, but only the right to remove the trees or other obstructions in a reasonable manner, and to use the earth in a proper way, to build and maintain the road; and the public have only the right to pass and repass thereon in a reasonable and proper manner. For all other purposes, you, in general, have the same rights that you had before.

Makepeace *v.* Worden, 1 N. H., 16.

Baker *v.* Shephard, 24 N. H., 208.

Graves *v.* Shattuck, 35 N. H., 258.

Winship *v.* Enfield, 42 N. H., 197.

You are not bound to fence at all against a highway, but if you do you must put the fence outside the limits of the highway. You cannot, as in the case of division fences between the adjoining land-owners, put one-half the fence or wall upon the land held by the public, nor take one-half of a three-feet ditch therefrom. If you do fence, you have the same rights to the grass, and the fruit of your trees, whether they are on one side of the highway fence or the other. If any one hitches his vicious or cribbing horse to your trees which are within the limits of the highway, and the horse gnaws the bark or otherwise injures the trees, the owner is liable for that damage, just as he would be if the trees were on any other part of your farm; and your neighbor has no more right to mow or pasture the half of the highway nearest your fence, than any other part of your land.

Avery *v.* Maxwell, 4 N. H., 26.

Gilman *v.* Emery, 54 Me., 460.

Few things gladden the eye more than neat fences and broad and well-made roads. They seem to introduce us at once into an atmosphere of thrift, taste, intelligence, and public spirit. The mass of highways were originally laid out of a suitable width, but year by year, with every renewal of the fences, or otherwise, here a little and there a bit, some crabbed and

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parsimonious soul in almost every community has been encroaching upon what belonged to the public, — stealing a few inches or feet from the heritage set apart for the common good, — until in many places a highway originally four rods in width has been narrowed to one from eighteen to forty feet. The courts in this State, imitating the Babylonian queen, once held that this stealing from the public was lawful if kept up continually for twenty years or more, but that day has passed by, never to return. In 1870, in State *v.* Franklin Falls Co., the same court decided, that no one could rob the community in this way; and in 1862, the legislature passed an act which is still in force, providing that no owner of land adjoining any public highway, town-house, school-house, or church-lot, or any parade or other public grounds, should acquire any prescriptive right thereto, by fencing in, inclosing, or occupying the same adversely for *any* length of time; and declared the same if knowingly done to be a crime, punishable by a fine of one hundred dollars or six months' imprisonment, or both, for each offense.

General Laws, 190, sects. 8, 9, 10.

The law, too, provides that "the owners (meaning the owners and occupants) of adjoining lands *under improvement* shall build and repair the partition fence between them, in equal shares."

General Laws, 342, sect. 1.

The owner of land occupied as a site for buildings is in general under the same obligation to build and support his share of the fences as he would be if the same land were used for a garden or a corn-field.

Wiggin *v.* Baptist Society, 43 N. H., 260.

But this is otherwise when the buildings are public and the land is open to the use of the public. The law proceeds upon the ground that these partition fences are in general to be built and erected where the land is used for agricultural purposes. The statute providing for the erection and maintenance of these fences is a just one, but has never been half enforced in this State, owing to the doubt as to what was meant by the words "under improvement."

It is now settled that all land actually used for tillage, mowing, pasturage, orcharding, and the like, comes under the statute,

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and that whether any other does or not, is a question of fact to be determined by the jury, who are largely farmers. The fences must be four feet high, or what is equivalent to it. Ditches and hedges are as much fences in the eye of the law as any other. It formerly was otherwise, but whoever builds such fence or wall may put one-half of it, if of reasonable width, upon the land of the adjoining owner; but if he should make such partition wall or ditch more than three feet in width, the court would probably hold it unreasonable.

The statute allows parties to make division of the partition fence, and provides that if that division be put in writing and recorded in the town records, or established by usage or the acquiescence of the parties and those under whom they claim for twenty years or more, it "shall be binding upon the parties, and all succeeding owners and occupants of the land."

General Laws, 342, sects. 2, 3, 4.

But the courts have decided that this does not mean precisely what it seems to say, for when the entire fence has been properly divided, one of the owners may lay a part of the land upon that line in common, and be relieved from further maintenance of the fence even though that part of the fence had been assigned to him and he had built it. In such case the other owner will be entitled to a new division of the rest of the fence.

Jones *v.* Perry, 56 N. H., 134.

But the law does not stop at this point. The court hold that these agreements must be construed to refer to "the state of things existing when the fence was divided," —

Same Case, 50 N. H., 139, —

and that, in consequence, if a part only of the conterminous land is sold, introducing new proprietors, the written agreement ceases to bind any one, and a new division must be had if any one calls for it.

Same Case, 50 N. H., 139.

The great object of the law which required every man to keep his cattle on his own land, or surround it with a fence, was not to keep other people's cattle out, but to keep his own in. If the parties cannot agree upon the division of the fence between them, they, or either of them, may call out the fence-viewers,

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who have full power and authority to make and provide for the enforcement of a proper division. But they cannot settle disputed lines or establish boundaries by virtue of their office.

Gallup *v.* Mulvah, 24 N. H., 204.

The duties of fence-viewers are mainly judicial, and therefore they cannot act when they are interested, are related to either of the parties within the prescribed degrees, or when they would be disqualified to sit as jurors if the cause came on in court.

Sanborn *v.* Fellows, 22 N. H., 473.

General Laws, 123, sect. 7.

Northern Railroad *v.* Enfield, 57 N. H., 508.

The fence-viewers are often appointed by the selectmen. Those who cannot hold the scales even, through mental or moral unfitness or because of their prejudices, interests, or connection by blood or marriage, should never be appointed. If one of the selectmen would be disqualified to sit upon the case as a juror, the others must fill the vacancy or vacancies in the board of fence-viewers, where any member or members of it are disqualified to act. If two selectmen are disqualified, the other must appoint. But for years, anomalous as it may seem, if all of the selectmen were disqualified they could all act in making the appointment. Two disqualified selectmen could not create a qualified board, but three could. An old farmer, who was a great friend to me in my boyhood, used to tell me that there were "a great many kinks and turns in the law." This is one of them. "Corruption puts on incorruption." *Less* corruption begets corruption. This was the law. Who made it? A former legislature. How do you like the looks of it?

By the statutes which took effect Jan. 1, 1879, the law was so changed that whenever the whole board is disqualified the selectmen shall in writing so inform some justice of the supreme court, who shall thereupon, with or without notice, appoint a new board for that case, from qualified persons who have before holden the same office.

General Laws, 123, sect. 8.

The law of partition fences has, however, no application to railroads. The statute provides that railroads shall build and

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maintain partition fences on each side of their road, except where public highways cross their track.

General Laws, 388, sect. 1.

And the same section provides that at the crossing they shall maintain such cattle-guards and fences as will prevent the cattle from passing upon their road. The law, however, does not compel railroads to fence against cattle that are unlawfully in the highway, or those that were unlawfully in a pasture adjoining from which they escaped upon the road through defective fences which the railroad was bound to keep in repair.

Giles *v.* Boston and Maine Railroad, 55 N. H., 552.

You must not forget as farmers that you are the most independent class of the community, and therefore should be the happiest. In general, your great work is measured by your toil from sun to sun. The burden of care which wearies the mind of the professional man by day, and pursues him like a phantom by night, you can thank your God, is not yours. As owners of the soil, you are not only the bone and sinew of the State, but the kings of the land. This gives you a great and controlling power if you see fit to use it, and puts upon you corresponding responsibilities. Use your power well, but do not forget that governors and legislators are the servants, not the masters, of the people, and that as you are, so will they be. "Like master, like man," is an old and true proverb.

You are as well protected under the law as any class, and your duties are substantially the same as devolve upon us all. See to it, you who are members of the legislature, that the laws which you make, as servants of the people, are good ones. Make few, repeal more than you make; and then, indeed, as was aptly said by one of the greatest of our great men, "the blessings of good government shall descend like the dews of heaven equally and upon all."

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FRUIT-CULTURE.

BY WILLIAM H. HILLS, OF PLAISTOW.

In the treatment of budded trees the second year, all side branches should be removed, while the tree is in a dormant state, as high as where the top or head is to be formed. The height is partly a matter of taste or fancy, and partly a matter of convenience. Of course there is a right and wrong way, and the taste and hand of the person who wields the pruning saw and shears, should be controlled by good common sense.

THE PEACH.

There is no question but that the peach should be trained low. But few of the lower side branches should be removed. The aim should be to give it a well-formed top, and this may be done with a very little pruning. Cut out all dead, weak, and immature wood, and pinch off the ends of the most rampant branches during the growing season. Just before the close of the season, shorten in the new growth, about one-half its length. This will keep the top compact and well-balanced, enable the tree to bear up its crop of fruit better, and gathering will be much more convenient.

The proper age at which to transplant a peach-tree from the nursery to the orchard is when the bud has made one year's growth. The spring, as with all stone-fruits, is the best season. In fact, there is always more or less risk in transplanting any tree, in this latitude, in autumn. But peach-trees are by no means as tender as many suppose. Of course there are tender

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varieties, as of the pear and apple; but if a judicious selection is made, and the trees are properly grown, — not forced, — they will be found to possess a great amount of endurance.

The spring following the winter of 1856–57, when mercury congealed in some localities, indicating a degree of cold about 40° below zero, and when, for five or six weeks, snow and ice did not thaw in the sun, there was quite a general, though not full, flowering of the trees in this county. I heard of no trees being winter-killed. I at that time formed the opinion, which I have since seen no reason to change, that peach-trees and their fruit-buds are not injured so much by intense cold as by the frequent and extreme changes in temperature that characterize our northern winters. It is a very common, though mistaken notion, that the fruit-buds of the peach are killed whenever the thermometer registers 10° below zero. Peach-trees have flowered in Rockingham County, and are now in fruit, — June, 1880, — in localities where the thermometer sank to 18° below zero during the past winter. Protection from heat is often quite as important as protection from cold. First, see that your trees are grown slowly, and the wood well matured. Second, mulch the ground around your trees *after it is frozen hard* in the fall, so that the frost may be retained, and prevent the buds from swelling in spring till all danger of severe weather is past.

The peach-tree requires the application of very little nitrogenous manure. The great danger is that it will continue to grow too late in the season, and make too much unripe wood. If the tree completes its growth early, and casts its leaves before being touched by severe frosts, it will be in the best possible condition to endure the cold of winter, and give a crop of fruit. It will be readily seen why land for a peach-orchard should not be made rich. Such treatment causes a late, rank growth of immature wood, that will not bear our extreme changes of temperature. It is taken for granted that trees are not to be set except on land already under cultivation, and, if this is in fair condition for the production of ordinary farm crops, but little extra fertilization will be required. A little old compost, or, what is better, a dressing of ground bone and wood-ashes, will meet the case perfectly.

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The peach-tree is usually regarded and treated as a short-lived tree, but it will endure for many years with proper management on soil adapted to its growth. For a peach-orchard in New Hampshire, I should select land sufficiently elevated to be free from early frosts in autumn, and having a northwesterly rather than a southerly or easterly exposure. A clay loam is well suited to the peach, but it sometimes succeeds well, for a few years, on gravelly or sandy soil. Land for a peach-orchard is too often chosen from the poorest part of the farm, and thus failure is insured from the beginning.

Trees for transplanting should be carefully dug from the nursery rows, so as to preserve the roots free from mutilation. The fibrous roots are of no consequence, as they usually decay, and have little or nothing to do with success or failure. Cut off smoothly the ends of all roots that are broken or injured in digging, and all the roots may be shortened to one foot in length, without injury. Cut back the top of the tree to two and a half feet in height, and remove all side branches close to the stock. This may seem rather harsh treatment, but it is the approved method with the most experienced growers. In transplanting, keep the roots constantly protected from the sun and drying winds. Immerse the roots in a mixture of clayey loam and water, just thick enough to cover the roots and cause the soil, as it is filled in around them, to adhere closely to every part. A dampened furniture-mat, hay-cap, or horse-blanket may be thrown over the bundle of trees while the operation of transplanting is going on; or the roots may be covered with soil, and removed, one at a time, as wanted.

The peach-tree will often yield a small crop of fruit the third year from seed, and has been known to mature fruit sixteen months from planting. One need not wait long to see the fruit of his labors, even if he grows his own trees; but, if in a hurry, he may order from some reliable nurseryman. Select northern-grown trees, and such as are low and stocky, rather than slender whip-stocks that have been grown on the high-pressure system.

Sometimes a peach-orchard is set in alternate rows with apple or pear trees. It will give place before the larger and slower-growing trees require the space. This is hardly advisable where

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land is abundant. As the trees are usually set pretty close, there can be but little cultivation after a few years, and that must be with the cultivator, harrow, and fork, rather than with the plow. Deep plowing, if practicable, would only be mischievous. Fifteen or eighteen feet are suitable distances at which to plant out. The trees, at either distance, if well cared for, will completely cover the ground. A newly-set orchard is not injured by the growing of some hoed crop between the trees, such as potatoes, or any of the root crops, up to the time of bearing; or the space between the rows may be occupied by strawberries or any of the small fruits, without injury to the trees.

The great enemies of the peach-tree are the borer, and the disease known as the yellows. The borer originates from an egg deposited by a moth near the surface of the ground, where the bark is tender. The egg soon hatches, and the grub at once gives his attention to business. Like any other workman, his presence may be known by his chips. In the early stages of his career, he may be easily cut out with the point of a knife; if neglected long, probing with a flexible wire will become necessary. The roots of every tree should be carefully examined at the time of transplanting, as the borer is often found in trees as they come from the nursery. I have taken ten or twelve from a single tree. This insect will soon destroy a peach-orchard if not exterminated seasonably.

The yellows is a more difficult matter to contend with. It is a contagious disease, and no one knows its cause or its cure. The only thing to do, in the present state of knowledge, is to root out and burn a tree the moment it shows signs of the disease. It is believed that pruning a healthy tree with a saw or knife that has been used on one that is affected, will communicate the disease. Fortunately, the yellows has not spread much at the North, and great caution should be exercised to prevent its introduction. Trees, and even pits for planting, from localities where it prevails, should be rejected.

At meetings of the Board of Agriculture during the winter of 1878–79, I have taken occasion, in discussing "Fruit-culture," to recommend one more trial of the peach. In some instances, this advice provoked a smile, and there was quite a general

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feeling of incredulity manifested at the statement that the peach, with proper treatment, may be profitably grown in New Hampshire. I did not anticipate that such abundant evidence of the truth of my statement was so near at hand. Within a few months we could hardly take up a paper without seeing one or more items giving accounts of remarkable crops of peaches in this and adjoining States. The only regret we heard expressed by fruit-growers was, that they had not set more peach-trees years ago. The result has been that many trees were set last spring, and when favorable seasons occur, as occur they will, we shall find our markets better supplied with northern-grown fruit than for many years. There is plenty of room for more peach-trees all over our State, and a few should be planted out every year. The trees may be grown on the farm where they will cost little or nothing. Do not wait for seedlings to bear, only to find out that they are unfit to eat, but learn how to bud, and be sure that your boys acquire the art.

The process of budding is very simple, and may be mastered in one short object-lesson, but cannot be easily described without the aid of cuts. A description of the process, well illustrated, is given in the New Hampshire Agricultural Report for 1878, pages 325 and 326. A copy of this report may be found in every town-clerk's office in the State, to which any person interested may have access.

THE APPLE.

The apple-tree should not be transplanted to the orchard till it has made two or three years' growth from the bud. The sooner it is placed in the position where it is to remain permanently, after the top is well formed, the better. The older and larger a tree is when transplanted, other conditions being the same, the less likely will it be to succeed. An old tree, or vine, is worthless, and should never be accepted as a gift.

If the bud makes a rampant growth the first year, let it be cut back to the height where the top is desired. There is little danger of too high a top on the Roxbury Russet, Rhode Island Greening, or any of the varieties having a drooping habit; while the Northern Spy, King, Early Bough, Benoni, etc., are

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inclined to carry their heads high, and may be trained comparatively low in the nursery.

The difference in the habit of growth must be taken into consideration in fixing the distance at which trees are to be set in an orchard. So, also, the character of the soil must be regarded. Some varieties, on strong soil, will require forty feet each way, while others will not crowd at twenty-eight or thirty-two feet. These distances may be regarded as most suitable for an apple-orchard, varying as varieties and soil vary.

PRUNING OR TRAINING YOUNG TREES.

This should be done mainly when the tree is in a dormant condition, — after it has completed its season's growth. Severe pruning in summer always gives a tree a shock, from which it will require several weeks to recover. Pinching in the tender ends of the too rampant branches may be practiced without injury, but much cutting had better be delayed till the leaves have fallen. In pruning to form a top, great care should be exercised to remove all surplus branches, and to give such as remain the right direction. Never, if it can be avoided, allow a top to be formed by two branches only. Such a tree is sure to be split down by the weight of its fruit, or by ice and snow in winter. There should be a leading central shoot, a continuation of the main stock, or body, and the branches should radiate from this center like the spokes from the hub of a wheel. Such branches cannot cross each other. Some varieties are inclined to send off lateral branches at right angles. They shoot from one side of the tree to the other, and not only spoil the symmetry of the top, but at the same time chafe and injure other branches, causing wounds not easy to heal. All such lateral branches must be removed at once. There will seldom be occasion for such removal if early training has been properly attended to.

TRANSPLANTING.

At the time of transplanting, it is well to remove all surplus branches entirely, and shorten in those that are getting too strong a lead. We hear much said about cutting back half or

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two-thirds of the previous year's growth, to preserve the balance between the roots and top. That trees, thus treated at the time of transplanting, will live, I have no doubt, but its utility is questionable. I have set an orchard of eight acres, without shortening a branch that I wished to retain, or losing a single tree. After testing both methods, I find but little advantage in shortening in more than is necessary to give the tree a perfect form.

The secret of success in transplanting consists in having the tree carefully lifted from the nursery, careful protection of the roots from the sun and drying winds, careful pruning of all mutilated roots, the careful arrangement of the roots in their new bed and compacting the soil around them, and the careful mulching of the ground about the tree when planted. The use of water is seldom advisable, and, if the soil is fairly moist, never necessary.

Thousands of valuable trees are spoiled by careless digging and exposure. The roots are bruised and broken, and often so short as to be insufficient to hold the tree in position when planted out. No wonder that "staking up" is recommended and practiced. Let the roots be preserved entire, if possible, and made to radiate from the center, when the tree is set, as suggested for the branches. This will give the tree support on all sides, and prevent inclination as the tree attains age.

"Taking up" and "setting out" trees is a business that must never be intrusted to careless boys or unskilled men. Give your personal attention to the work, but first be sure that you understand how to do it yourself. I have in my mind a man who prides himself in his ability to raise trees by "main strength," without the aid of "pick-ax, spade, or shovel." This is a "trick of the trade," however, not often practiced except in cases of emergency. Nurserymen usually commence well, but, like men in other professions, suffer their consciences gradually to toughen up, till they are able to perform the most cruel operations with apparent indifference.

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THE TIME TO TRANSPLANT TREES.

As to the best time to transplant trees, nurserymen and others of large experience disagree. As for myself, I feel confident that all tender varieties, such as the pear, peach, and cherry, in this latitude, had better be transplanted in the spring; but the apple, and hardy varieties of ornamental trees, do well *usually* when moved in the fall. But this is not the case uniformly. Some years ago I lost about one-half of a very fine lot of Baldwin apple-trees, — the only apple-trees I ever lost by transplanting, — by removing them in autumn. The tops were killed even with the snow, while the roots, and part of the bodies, were uninjured. Nurserymen sometimes recommend the autumn as the best time, because they are more at leisure to attend to selling; but, notwithstanding the hurry of spring-time, I have done nearly all my transplanting at that season. Where a nursery is accessible, persons wishing to purchase trees should, by all means, make their selection in the fall, when the seller has leisure and before his stock has been culled. The trees can be labeled, and taken up when convenient with a degree of care which it is not possible to exercise when customers are pressing, all anxious to be served first, for the reason, most likely, that they have all put off their purchases till the last moment.

DO EVERYTHING CAREFULLY AND THOROUGHLY.

Whatever the season chosen for transplanting, let the work be done in the best possible manner. If a damp day can be selected, all the better. Dig liberal holes, so that all the roots may be arranged in their natural position, and not cramped like a foot in a Chinaman's shoe. Fill the hole with fine soil of good quality, and press it gently but firmly down. Dashing water in the holes will do more harm than good, and no manure should be placed in contact with the roots. If used at all, let it be spread upon the surface. Before hard freezing, heap some good garden soil or fine compost about the body of the tree. This will serve the triple purpose of supporting the tree against the wind, protecting it from the depredations of field-mice, and, spread and forked in the following spring, will greatly promote its growth. Strawy manure should be avoided, as it would afford a shelter

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for mice rather than repel them. For this reason, all straw or mulch which may have been placed around young trees during the dry season, should be removed before the ground is covered with snow, unless the trees are in some way made secure. With due precautions in this particular, there can be no doubt that trees, especially on cultivated soil, are much benefited by mulching in the fall. Trees are often injured by the action of frost on their roots, and the danger is much greater on land under cultivation than on that which is protected by a thick covering of grass or its equivalent. The ground in our forests scarcely freezes at all, and it is doubtless owing to this cause, in part, that so few forest-trees are killed by the severity of our winters.

The practice of mulching fruit-trees in autumn, with a liberal quantity of good manure, is one which produced very satisfactory results with me. The experiment is a safe one, and those who wish to try it should perform the operation before the fall rains occur. The rains and freezing nights of autumn will disintegrate all lumps, and do the work of properly preparing all fertilizers thus applied for the use of plants most perfectly. The action of frost on land is too familiar to require any remark; no amount of spading can put the soil in such admirable condition for receiving manure in liquid form.

How different in spring, the usual time of applying manure. The work is often delayed till late, just before the hot, dry season commences, when solid manure is sure to become more solid, and hence nearly worthless for all purposes of vegetation. Many seem to forget — if they ever knew — that fertilizers are taken up by plants in a liquid state, and not in their solid form, and that manures must be applied in that form, or else applied at a time when they will assume that form with as little delay as possible. My own experience has convinced me that trees receive more benefit from manure applied in the fall than at any other time. An early and rapid growth is quite sure to follow the next season; while manure applied after the tree has commenced its growth in spring, seldom produces any very marked effect till the second year. This stuffing of your turkey after your guest arrives won't do. But if any one has fears lest his trees or plants will grow too rapidly, let him apply his manure

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in June or July. He will be sure to see the effect, if at all, "*after many* days."

FIELD-MICE.

The damage done to fruit-trees by field-mice is often very great. In some instances, arbor-vitæ hedges and evergreen trees are ruined. Small trees by the roadside and scrubs in the pastures have been stripped of their bark to the ends of the smallest twigs. It is quite possible that these depredations may be repeated the present winter, and it is of the first importance that all young trees receive early and careful attention. Everything that will afford shelter for mice, such as grass, weeds, and rock-heaps, should have been removed from the vicinity of small trees before the first fall of snow. Trees standing near stone-walls, hedge-rows, or meadow-lands, or on land where the green-sward has been turned in the fall, are in great danger of injury. Fences and furrows afford ample protection to the mice when there is but little snow on the ground. They pass from tree to tree, under the turf, by a sort of underground railroad, destroying everything on their track.

Heaping the soil around the bole of each tree to the height of a foot, as above recommended, will usually be found an effectual safeguard. Mice will not often make their paths over sharp elevations, however small, but prefer to "switch off," and pass around all obstacles; and in this way the tree escapes. When banking up has been neglected, it will be of much service to tread the first snows firmly around the trees, and this should be repeated towards spring, or whenever, from any cause, the snow becomes soft. Sheets of tin, — old or new, — first passed through the tinsmith's roller, so as to fit close to the body of the tree, would afford a perfect protection. They could be easily removed in the spring, and, if preserved, would last many years. The expense would be small compared with the value of a young orchard of thrifty trees.

I have seen it stated that the application of two or three quarts of *slacked lime* around each tree will not only protect the tree from the depredations of mice, but promote its growth. Whitewashing the tree near the ground with a wash made by

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putting in one pound of the flour of sulphur to a peck of quick-lime, when slacking, covering the cask at the time with an old sack, will not only repel the mice, but also the moth that is the parent of the borer. Coal-tar has sometimes been used, effectually keeping at bay the mice, but, unfortunately, killing the trees. *Chloride of lime*, which is very obnoxious to rats and mice, such as infest our cellars and buildings, might be used successfully; but of this I am not sure, never having tested it. It is not an expensive article, and the experiment may be worth trying. Permit me to suggest one other experiment. I have never known mice to girdle the white or gray birch. The bark of either can be obtained in almost any locality. It will fit around the trunk of any tree without the use of curling-tongs, and can be applied to a large number of trees in a few hours.

PRUNING.

My idea about pruning is, that it is an unnatural operation. I would never cut off the limb of a tree, if I could possibly help it, any more than I would cut off one of my children's fingers, unless it was diseased. It is all unnatural; but, if you find a limb going where it ought not to go, it is better to take it out, and thus prevent its crossing another limb, and producing a wound which will result in the destruction of both.

As to the best time for pruning, that depends somewhat on the condition of the tree. Pruning in summer is sure to give the tree a shock from which it will take time to recover. If your tree is vigorous, and making wood rapidly, pruning in June will give it a check, and often bring it into bearing the next season. But if your tree is unthrifty, making little or no growth, prune when it is in a dormant condition. In the fall, after the leaves have fallen, or on pleasant days in winter, go through the orchard with ladder, saw, and pruning-shears; see what limbs ought to come out, saw them off eight or ten inches from the tree, and carry them to the brush-heap. You can then see just what wants to be cut out. Then, the next June, go round with a sharp saw, and carefully saw off the stumps, and coat them over in the manner hereafter described.

I am perfectly satisfied, that, if a tree is in a thrifty condition

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and is trimmed with care, June is the best season to perform the operation, and for this reason: if you trim early enough, before the tree has made its growth, the wound, as I have repeatedly observed in my own experience, will heal over almost completely the first year. I have preferred this season on that account. It may be said that you may trim earlier than that — in April or May. Well, the disadvantage or danger of trimming at that season is, that a tree trimmed in April, or before the growth has commenced, will bleed, almost as surely as a grape-vine pruned in spring, and the sap will run down the trunk of the tree, and it seems to me that, for some reason, I do not know what, this sap is as poisonous to the tree as anything can be; and when you have got the sap running, you cannot stop it by any application that I have found. It will run, not only that season, but the next, and your tree is liable to be ruined. Such wounds will never heal over. To avoid this, I have pruned in the fall, winter, or in June. I should say, never prune a tree between the tenth of March and the first of June.

But there are some objections to June as the time for pruning. It is a very busy season, and when planting is hardly over, and hoeing and haying are pressing, pruning is quite likely to be given "the go-by." This is not the only objection. In June a tree is growing rapidly. Everything about it is then in the most tender condition. The bark slips at every touch, and if you step into the tree, with heavy boots, you are sure to do more mischief than the pruning will do good. The new wood that has grown has not ripened at all, and if you saw off a limb in the top of a tree and force it down through, you injure the tree itself; you strip off the foliage of the tree, which you do not wish to injure at all. It is injurious to pull limbs down through a tree when it is making its tender growth, and June is, therefore, a bad time of the year to prune on that account. I have already suggested that a season of the year when a tree is divested of its foliage is preferable to any other, because you can see *where* to prune better than when the tree is in full leaf. You can see what branches are going astray, starting from one side of the tree and pushing towards the other where they are sure to cross other branches and do mischief.

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PRUNING IN SPRING.

This is the worst time to prune in the whole year. There can be no doubt on this point. Some do not understand the effect of pruning in the spring. Prof. J. G. Hoyt of Exeter invited me out, some years ago, to look at his young orchard. He had selected the trees with the best judgment and greatest care, and paid an extra price for the first pick of a nursery that I well knew. I went out and looked at it, and found it had been pruned in the spring, before the leaves started, and the sap was running down from every wound. He said, "Can you tell me the cause of this?" — "Yes," said I. "You pruned the trees at the wrong season of the year. You pruned them before there was any foliage to absorb the sap as it was flowing up the trunk and branches." I saw that orchard five or ten years afterwards, and it was literally dead, only a few of the trees remaining. It was absolutely ruined by pruning at the wrong season of the year. This is the result of spring pruning; yet there are men who go about every spring offering their services as experts in pruning trees, working by the day and hour, or for the cider they can drink; — men who know nothing about trees, and having no decent amount of knowledge on any other subject. There should be a stringent statute to suppress such tramps as much as against the beggar tramps that formerly perambulated our streets.

NEVER PRUNE IN WET WEATHER.

Always choose a bright, sunny day for pruning, a mild day, when the tree is dry, the air is dry, and everything is dry, with a prospect of sound weather for two or three days. The reason is that we want the wound, and any application we may make to it, — for all wounds should be at once covered, — to become dry and hard. This condition secured, there is not much danger that the wound will bleed afterwards.

The inquiry is often made, "What shall we use to cover wounds made by pruning?" Common paint is sometimes recommended, and often used. It is said to answer a good purpose, namely, to exclude wet, and preserve the wood from decay. It has the advantage of being easily applied. But I

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have a prejudice against the use of any preparation containing oil or grease. There is another method of covering wounds often used by men who make a business of grafting. They mix clay with hair, making a soft mortar, such as plasterers use. This will not injure the tree, which is more than can be said of some other preparations, and it is claimed that it will absorb the sap, if the wound bleeds, and afford sufficient protection from the weather. I think of only one or two objections to its use. It is not very convenient to apply; is soon loosened by the enlargement of the tree in growing, by storms or frost; and birds often pick it off when building their nests for the hair it contains.

SHELLAC VARNISH.

I use nothing but a preparation of gum-shellac, dissolved in alcohol to about the consistency of molasses. The most convenient way for using this preparation is, to fix a sponge on a piece of wire and put it into the stopple of a wide-mouthed bottle, — a common horse-radish bottle is just the thing, — fill with the preparation, and use it to coat over all wounds, just as you would use sponge-blacking. A small brush, such as painters use for drawing sashes, costing ten cents, will be quite as convenient as the sponge. Make a hole through the stopple of the bottle large enough to receive the handle of the brush, and the arrangement is complete. Keep your bottle closed as much as possible, as the alcohol, when exposed, like a political speech, soon vanishes into "thin air."

If the day is bright, this application will harden in half an hour, so that you can hardly make any impression upon it with your thumb-nail. The sap cannot get out, and it will exclude the wet from the outside. This is the way in which to stop the escape of sap from an amputated limb of a fruit-tree. The preparation here recommended is precisely the same as used by painters in coating over knots before painting, to prevent sap and pitch from showing through their work. It will keep out the wet and keep in the sap. Any dealer in painter's supplies will furnish it at about fifty cents a pint, ready for use.

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GATHERING AND PRESERVING FRUIT.

The quantity of fruit annually wasted, through ignorance and neglect, is very great; still more is injured by premature decay, and very little is ever found in perfection. Good judgment and much careful observation are required to determine the precise time for gathering, and the best means of preserving, the different varieties.

Some kinds of winter fruit should be gathered two weeks earlier than others, and there is often much difference in the time of ripening between trees of the same variety. As a rule, both the foliage and fruit of a tree on strong land, under high cultivation, will adhere to the tree much later in the season than in case of one on light soil, only moderately thrifty. Hence, no precise date can be fixed for gathering winter apples; it will depend upon the variety, location, season, and state of cultivation. From the first to the fifteenth of October is, perhaps, regarded by a majority of fruit-growers in Rockingham County as the best time for gathering the Baldwin. The apple is not injured by frost, and the color and flavor of the fruit are much finer if allowed to remain on the tree till ripe. A safe rule is to gather pears and apples on any cool, clear day, as soon as the fruit will part readily from the tree. If picked earlier, many of the fruit-spurs and stems will be broken; in one case injuring the tree, and in the other, the fruit. If apples are neglected too long, the fruit will be injured by falling.

Pears should be picked from the tree just as they *begin to ripen*, — not all at once, — and about a week before becoming mellow. The "golden opportunity" occurs just as the fruit assumes a brassy hue on the side exposed to the sun. Most pears are better if ripened in the house than when they are allowed to grow mellow and mealy on the tree, and keep much longer. The winter varieties require to be kept cool, dry, and away from the light, till a few days before they are wanted for the table, when they may be taken to a moderately warm room, where they will ripen to perfection.

All fruit worth preserving must be picked from the tree by hand, the greatest care being exercised, both in gathering and packing, to avoid bruises or any injury to the skin, which is

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the natural protection of the pulp. The slightest rupture of the skin, from whatever cause, is sure to be followed by premature decay, and a bruise is only a little less fatal. The skin of the apple, grape, and most other fruits, is nearly impervious to air and moisture, and those varieties having the most dense skin will, as a rule, remain longest in a sound state; while those having a tender, thin, or porous skin can only be preserved by artificial protection.

It has come to be a familiar fact that vegetable substances cease to decay in vessels from which all atmospheric air is excluded; but just why this result follows, is not so generally known. All decay, chemically speaking, is simply slow combustion, and without air there can be no combustion. Hence it is that glass and the finer metals never decay, or, in other words, burn up, and fruits protected from the air, either by natural or artificial means, remain sound. I have found, by actual experiment, that apples packed in air-tight casks will keep much longer than in those admitting air freely. This may be owing in part to the fact that light and moisture are excluded from a tight cask as well as air, and the temperature is more uniform.

Fruit should never be handled when damp, and packing should always be done on a dry day. When apples are gathered, let them be taken to a cool out-building, and allowed to remain in a pile till they have parted with a portion of their watery substance by the sweating process. When packed in the field at the time of gathering, as is the practice with some, much fruit, that two or three weeks later would be rejected, is accepted as marketable. The aim should be, in the management of winter fruit, to have it perfectly mature, carefully selected and handled, securely packed in clean, air-tight casks, and stored in a dry cellar, having a low and uniform temperature.

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SORGHUM AND CORN AS SUGAR-PRODUCING PLANTS.

BY PROF. PETER COLLIER, OF WASHINGTON, D. C.

THOSE of you who have seen that admirable representation by Mr. Raymond of "Col. Mulberry Sellers," in the "Gilded Age," will remember how he proposed to pile up a colossal fortune by the sale of eye-wash to the teeming millions of Asia, and finally concluded with the assertion that there were "millions in it." Now, I am going to speak almost entirely by millions, and yet I think I appreciate, as I trust none of you do, how much a million dollars is; indeed, how much five dollars is. But I shall deal in millions, and I am delighted to be here before you, older and wiser men, that you may yourselves take the facts which I have, and concerning which I am only solicitous (I am prepared to defend *them*), and say whether I am astray one whit in the conclusions which I draw from those facts.

Now, in regard to the magnitude of the question, I will say that few of us can possibly realize it. I am going to speak about the production of sugar at home, and from material that has hitherto been regarded as refuse. I think, if anything characterizes this age, as distinguished from others, it is the utilization of refuse material, waste products, and we all of us know, when we consider for a little, how abundant those are upon the farm, how important it is to utilize these materials as far as we are able.

Now, this waste, I say, is almost incredible in the matter of

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sugar. We imported last year $109,000,000 worth of sugar, counting the duties and the original cost, and, of course, they both come out of the pocket of the consumer. We have imported, since 1848, when gold was discovered in California, an amount of sugar which has taken for its payment the entire product of all our gold and silver mines of the West, — $1,800,000,000. Imagine what might be our present condition financially if we could have saved all of this money! We hear sometimes of the bonanzas of the West, of the Comstock lode, and of Leadville, but all those bonanzas, not only of the past two or three, but of the past thirty years, large or small, have sent abroad their products to provide us with sugar. We consume, on an average, every man, woman, and child in the United States, between thirty-five and forty pounds of sugar annually, and we would consume, were it only half as expensive, twice as much, because, as you all know, it is a healthful, nutritious, and, moreover, a delicious food. But all this time we have been throwing away a material which would have furnished us, had we availed ourselves of it, with a thousand million dollars' worth of sugar annually. We could fill the markets of the world with the sugar which we are annually throwing away unutilized.

The Commissioner of Agriculture has been hooted at by some as being insane on this matter of sugar. I am crazy the same way, — have the craze worse than he, I think, — simply because I have had more direct personal control of the experiments, while he has been cognizant only of their general result. I confidently predict that within five years we shall produce all the sugar we need; within ten years, we shall export more than we have ever imported. These are the conclusions I have drawn. That they are immense in their importance you will admit. I trust you will follow me carefully through, and see if the results that I have secured in my laboratory work, and some few experiments in the field, bear out and justify these conclusions.

I have been working chiefly with sorghum, but have made some experiments with corn-stalks, and I will speak first in regard to my experiments with sorghum, and then go into some little detail about the other.

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The sorghum is a plant, I doubt not, known to all or most of you. It resembles our broom-corn, which is another member of the same family, a sorghum, but the sugar-sorghums were imported some twenty-five or thirty years ago from China and from the coast of Africa, and they are now known as the Chinese and African sorghums. Although it is almost impossible to-day to get any seed of the varieties which were imported then, — they hybridize so rapidly, — yet we have some fifteen or twenty, at least, of different well-established varieties, as is the case with our Indian corn. Four kinds of sorghum were planted at the department last spring, the 15th of May, and an examination of those plants was made continuously during the season. Every three or four days a selected stalk was taken from the row each, and a complete analysis was made of it. The butt of the stalk, and the top, the upper and lower halves divided, approximately, into equal weights, for the purpose of learning what we could in regard to the development of sugar in these plants. The examination began when the seed-head first appeared, and was continued until the 29th of October — indeed, until about the 5th of November. On the 23d of October we had a heavy freeze in Washington, which gave us about half an inch of ice, and an examination was made subsequent to that to learn the effect of the freeze upon the sugar that the stalks contained, and of the effect of the subsequent thaw which ensued.

Now, I will give what we found true with one variety, and that was true of every other one. At the first examination, we found that the juice contained from four to six per cent of uncrystallizable sugar, and from one to three per cent of crystallizable sugar. Now, I would say, that the value of the juice, whether of sugar-cane, or beets, or sorghum, so far as the production of sugar is concerned, depends upon two things. First, on the amount of sugar, other things being equal, which is present; obviously, the more sugar in the juice the more you can get, other things being equal; but inversely upon the amount of uncrystallizable sugar which is present, because that will prevent your getting a large proportion of the sugar which may be present that is true crystallizable sugar. Now, the results, I think, will be intelligible. We found that at first there

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was from four to six per cent of uncrystallizable sugar, and from two to four per cent of crystallizable sugar. Now, there is no known practicable method by which any one can obtain from a ton of such juice a pound of sugar. We may prepare, and we have prepared, excellent sirups from such juice, but crystallized sugar, with our present knowledge, is an impossibility. But we found, upon subsequent examinations, that the uncrystallizable sugar diminished from four to five or six per cent until it came down to three, to two and a half, to one, and in one case to six-tenths of one per cent, whereas the crystallizable sugar increased until it became ten, eleven, twelve, thirteen, fourteen, and in one case seventeen per cent of the juice; and all of those different kinds we found, when in their best condition, to contain about one per cent of uncrystallizable sugar, and about fourteen or fifteen per cent of crystallizable sugar. Now, a juice like that is quite as good as the average of the best Louisiana sugar-canes. As evidence of that we sent to Louisiana (because it seemed possible there might be some defect in our processes — and I am not giving you the result of one or a dozen experiments — in the aggregate we made over two hundred and fifty separate determinations, and what I state is the general result of them all) and received from the president of the Louisiana Sugar-planters' Association about twenty stalks of three kinds of their best sugar-cane. They reached Washington in excellent condition. They were treated precisely as the sorghums had been treated, with the same re-agents, with the same methods, and the results showed that they were not one whit better than those sorghums were, in their best condition. I have a chart upon which these facts are given, but I can give them sufficiently near for practical purposes. I will say that the average of the best sugar-beets which we examined — the best five out of seventy-one which came from all parts of the country — was 12.46 per cent of sugar in the juice; less, you see, than those of sorghums.

Now these sorghums can be grown wherever corn can be grown. Before the convention of the National Patrons of Industry, at Canandaigua, I appealed to the sorghum-growers there, and thirty States were represented at that convention,

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and they all said that it can be grown with no more expense than an equal area of corn.

I made a few experiments to determine whether this sugar could be obtained which was present in the juice, and I found that, taking an average of the nine best sirups which I made by forty different experiments, using up in the aggregate over twenty-three tons of stalks of the sorghum — and I examined in every case the juice which I converted into sirup, and then examined the sirups after I had obtained them, that is, determined the amount of crystallizable sugar — I found that, taking the best nine of the sirups I made, I had obtained in the sirup 92.7 per cent of the sugar which was present in the juice. That is, it had practically suffered no inversion (by inversion I mean the conversion of the crystallizable sugar into the uncrystallizable condition). But I also examined the nine worst sirups I made. I mean by that, those which never would have yielded any sugar, because the amount of uncrystallizable sugar was so large. But I could determine by other means the amount of crystallizable sugar which was there, and I found that in the nine worst sirups which I had, I secured over ninety per cent of the sugar which was present in the juice.

Now these experiments are conclusive upon this point, that any of you, or any one in the country, by following the method that I did, may obtain in the sirup all the sugar which is present in the juice, or practically so.

Now in regard to the character of these best sirups that I made, I found that every one of them very speedily became semi-solid from the formation of crystals of sugar throughout the mass. They deported themselves precisely as sirups made from sugar-cane would have done. It was so thick that it could be shoveled into a cart and put into a centrifugal machine, as I would have done if I had had one; but not having one, it was put into a grain-bag, in which way I succeeded in pressing out the molasses which was present, and in obtaining a sugar which could be sold by the hundred thousand tons in any market in Christendom to any refiner, as good as the average best ten per cent of our Cuba or Louisiana Muscovado sugars, open pan sugars; and yet the apparatus I had (and it would have sufficed

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to have worked up a crop of twenty or twenty-five acres) did not cost over one hundred and fifty dollars. Mr. Aiken of South Carolina, to whom I applied as to the expense of his apparatus, said that one hundred dollars was sufficient. One hundred dollars, then, according to his statement, is sufficient to enable any one to prepare a product which is as marketable as bullion. I will say that my brother-in-law, a farmer in Central New York, this year tried the experiment with a few acres, and succeeded in making an excellent sirup, which he sold to his neighbors at fifty cents a gallon, until it was sold out. Some of it found its way to New York, and he had an order for five hundred barrels at fifty cents a gallon, which he could not fill. I have no doubt whatever that any one would have said that it was rightly worth it, if any sirup in the market was worth fifty cents a gallon. A gentleman at Crystal Lake, in Maryland, knowing what I had done last year, not this, thought it was worth while to try it on a large scale. He got a vacuum pan and worked up the sirup from an inferior material, and made forty-two thousand pounds of sugar, which he sold at ten cents a pound as a raw sugar. He was satisfied, as I understand, with his experiment, and is going into it again.

Now it seems to me that these facts are worth considering. I succeeded in making from every one of those sorghums which I could control at the rate of over a ton of sugar to the acre. The average product of Louisiana sugar-cane, according to an editorial in the New Orleans "Times" of November 21, sent me, was 1,350 pounds of sugar to the acre. I made at the rate of over a ton of sugar to the acre. I have not a shadow of doubt that from a hundred acres of good corn-land one hundred tons of excellent sugar can be produced. More than that, with certain varieties, which cannot be grown here in New Hampshire, however, to maturity, I have no doubt whatever that two tons of sugar can be produced to the acre. From a variety of sorghum which grows very large I obtained a crop which was equal to three tons to the acre.

The main point in regard to the whole matter, practically, was the time when the cane should be cut and worked up. That I found to differ very widely as to the period, but as to

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the evidences on the part of the plant it was identical. It was when the plant was thoroughly matured, gave every evidence of being ripe; when the lower blades were dead; when the seed was hard and dry, thoroughly ripe; when off-shoots had sprung from the upper joints of the stalk. Whenever the stalks showed those indications, no matter what the variety was, I found that the percentage of sugar in the juice was at its maximum. I found, moreover, that every one of them maintained that condition when once attained until this frost or freeze of October 23 put an end to them. Some of them had been two months in that condition, giving a time nearly twice as long as they have in Louisiana to work up their cane. So that in this latitude there is no doubt that you would have a period equally long for working up the crop that they have in Louisiana from the slow growing of the cane, which requires nine months — indeed, requires eleven or twelve months for its maturity. It never matures in Louisiana. Probably there was never a cane ripened in the State. Not one planter out of a hundred, probably, has ever seen a perfectly ripened sugar-cane, unless it was imported from some tropical country or raised in the hot-house.

One other point in regard to this. I have said that the amount of our importations of sugar aggregated last year one hundred and nine million dollars. We produce about thirteen per cent of the sugar we consume, and that is produced in Louisiana. Eighty-seven per cent is imported. It chiefly comes from Cuba, and if moral considerations were of any account here in discussing this question, our money goes to support an institution that we, thank God! have done away with, — slavery. Then there is another consideration, to illustrate which I will tell you a little story. I have a little girl at home who was delighted when in the afternoon I would bring a little package of brown sugar for her, not very presentable, perhaps; and one day, when she was eating it in company with the children of some of the families in the neighborhood, they said, "We have white sugar in our houses." — "But," said my little girl, "my papa made this." Now, it seems to me that that point would apply to us as a nation; that if it is possible for us to produce sugar economically, it would be a satisfaction to us to feel that

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we were self-supporting, that we were living within ourselves. I remember an old coin that was struck long before my time, but one of which came down to me, which had the legend upon it, "Not one cent for tribute, millions for defense." It seems to me that is a good point.

We are paying tribute to other countries, an enormous tribute, at a rate greater than the aggregate gold-production of the world, which was estimated last year at one hundred million dollars. We pay more to the sugar-growers of foreign countries than the aggregate production of gold in the world, and yet, as I say, we are now throwing away ten times that sum every year.

Now, a few experiments in regard to corn-stalks may be of value. But I will say first in regard to sorghum, that I think that is the most profitable as a sugar-producing plant, and I should advise any one who wishes to go into sugar to plant sorghum rather than corn. But we have rather insisted upon corn-stalks because it seems like eating one's cake and having it at the same time, and we thought that many farmers might go into this enterprise who would not wish to give up a few acres with the possibility of failure, whereas if they failed in the attempt to make sugar from their corn-stalks, it would not be of so much account. Now, our acreage of corn is so great that, without reaching even the results which we have secured in our trial, nine per cent of the acreage at present in corn in Illinois will produce all the sugar we import. The whole acreage of Illinois produces seventy-five million dollars' worth of corn. Nine per cent of that will produce one hundred and nine million dollars' worth of sugar.

I certainly have faith to believe that there are thousands of Illinois farmers who would do better than I would, practically, and I would undertake, if I could have absolute control of nine per cent of that corn-land, to produce that amount of sugar every year; and the same is true of the other States.

I do remember that of all the land we have under cultivation, including that in hay, cotton, cereals, and root-crops in the United States, thirty-eight per cent is in corn; so, as I say, we cannot touch this question without going into millions. The aggregate production of corn is four hundred and eighty mil-

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lions and a trifle of some six hundred thousand dollars, if we consider that a trifle. If we should give up one and a half per cent of that corn-land to the cultivation of sorghum, we might produce one hundred and nine million dollars' worth of sugar. That is, we can produce from one-tenth the ground a crop forty per cent more valuable than the produce of the whole; and the universal testimony is, that it costs no more to raise a crop of sorghum than it does to raise a crop of corn.

But here is another point, before we go into the matter of corn. I was examining the other day the returns from the country in regard to the production of cereals, and I must say that I was astounded at the exhibit. I found, taking the Western States, from Ohio west, ten States reported in 1862, and all of New England, the Middle States, New York, New Jersey, Delaware, Maryland, Virginia — eleven of them — I found that between 1862 and 1877, a period of only fifteen years, the corn-crop — and remember that thirty-eight per cent of our cultivated land is in corn — the corn-crop had fallen off in those Western States over twenty per cent in its acreage yield, and in those States which we may regard as older Western States, like Illinois, it had fallen off twenty-seven and one-half per cent in its acreage yield in fifteen years. It was no local blight or early frost which produced this result; it was continental. I took all these States and grouped them, and the result was a falling-off in fifteen years of over twenty per cent; and of wheat, the next staple cereal in value, the yield had fallen off 16.9 per cent in fifteen years. On the other hand, taking our Eastern States during the same period, the acreage yield of the corn-crop had fallen off but nine-tenths of one per cent; had practically maintained itself. The acreage yield of wheat had fallen off four and a half per cent only, as compared with 16.9 per cent in the West. More than that, I found that the average yield per acre in the East is to-day very much in excess of what it is in the West. On lands which have been farmed one hundred years longer than those of the West, we are to-day raising on each acre more corn and more wheat than they do in the West. I do not mean to say that we raise it so cheaply, bushel for bushel, but in regard to that matter no one will believe, perhaps

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it seems almost incredible, that even fifteen years ago they made twenty per cent on the corn which they raised; that every hundred dollars' worth of corn enabled them to put twenty dollars in their pockets. I know the question was discussed in this State, and you almost decided that farming did not pay one per cent on the investment. I hope it will make a better showing than that, but it is hardly probable that it pays in the matter of corn twenty per cent a year, and yet it has fallen off in fifteen years at the West more than the entire profits in its production; and we can easily calculate how soon the time will come when it will be impossible for them to raise corn at the present prices, and when they must have recourse to the same things which we came to twenty-five years ago, which England has come to until it has carried its agriculture in that respect to the utmost verge, and so eminent an authority as Mr. Lawes says, in his address to the farmers (I do not quote his exact language), that they have raised the very last bushel of cereals that they can raise profitably. They may possibly raise more by putting on more fertilizers, but the fertilizers will cost them all that the additional crop is worth; and consequently to-day we have a parliamentary committee coming over here to see if they cannot learn something from our methods of agriculture that will be of advantage to the English farmer. But, as I say, we are drifting into the same condition of things. Here it is a question, which I am not discussing, as to whether it will pay to use fertilizers, but we can see the effect of having used them, for upon our lands farmed for a century longer than those of the West, we are now producing more to the acre than the fertile lands of the West. Ultimately the time must come when the farmers of the West will have to put on fertilizers or adopt some other method of enriching their lands, which are so rapidly becoming impoverished. England, with a territory but little larger than the State of New York, imports annually, or did when I received the last statistics, and they were official from the London Board of Trade, twenty million dollars' worth of animal fertilizers or fertilizing material from outside her borders, not taking into consideration the acres of wheat that go into her breadstuffs and are consumed there, and go to enrich her soil by the refuse

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which the consumption of that crop leaves. The other day Prof. Ledoux of North Carolina said that last year they had used two million dollars' worth of fertilizers; in Georgia they had used three million dollars' worth. That is the recourse to which we have been driven to maintain the fertility of our lands. Now, this matter of the exhaustion of the soil becomes important. I have calculated the manurial matter in the corn-crop of our country alone, and, taking an average on the analyses of twenty-eight different kinds of corn grown all over the country, I find that the average manurial matter or ash in these corns is 1.63 per cent. Not a very large amount, — about a pound to the bushel; but we are dealing in millions now. Our corn-crop is, approximately, fourteen hundred millions of bushels annually, so that 1.63 per cent goes into the hundreds of thousands of tons of manurial matter in the corn itself; I have no reference to the stalks. This ash is composed, unfortunately, of two constituents which are the most expensive in those fertilizers which we buy, — phosphoric acid and potash, — containing about forty-six per cent of one, and about thirty-four per cent of the other. I calculated that, at the price which we are glad to pay for those two constituents when we buy fertilizers, the phosphoric acid and the potash in the corn-crop of the United States would amount to the amazing sum of ninety-nine million dollars, and the entire value of the corn-crop is only four hundred and eighty million dollars. Fortunately the phosphoric acid and the potash are about the only things of value, except nitrogen, but the phosphoric acid and the potash come from the soil, and the destruction of these impoverishes the soil, and it is with these that we have chiefly to do now. The entire corn-crop aggregates four hundred and eighty million dollars, and the phosphoric acid and the potash alone, if bought at the prices we are glad to pay when we get our money's worth and are not swindled in commercial fertilizers, is worth over twenty per cent of the entire value of the corn-crop. When the time comes that to maintain the fertility of the Western lands it is necessary to put upon them these constituents, as we are doing here now, you can see to what an extent it will diminish the profits of the culture of corn in the West.

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Now, in regard to this matter of sugar. Sugar, as you are aware, is a product of atmospheric constituents. We might export, if there was a demand for it anywhere, $1,000,000,000 worth of sugar every year, and our lands would not deteriorate one whit. On the other hand, there is no reason why they should not increase in fertility. Whereas, it is quite the reverse, as we have seen, when we transport the cereals from the land.

Now, in regard to corn-stalks. I have examined quite a number of corn-stalks at different periods of their growth. I started with some prejudices in regard to the matter, and, consequently, I supposed that the only time to examine them was when the ears were green, not hard, and I made only these experiments last year. The experiments resulted in making an excellent sugar readily. I have made examinations and analyses of the green corn to see how profitable it would be for feeding, hoping that the stalks, after the sugar had been extracted, might be profitable for feeding purposes. It is unnecessary, however, to consider even that, because we may allow the corn to ripen. And also we have enormous areas of corn grown for the purpose of canning. One gentleman in Baltimore had two thousand five hundred acres this year, all of which he canned at the rate of seventy-five acres a day, putting up seventy-five thousand cans every day, the corn-stalks remaining being treated as refuse. I have had a talk with him in regard to a project for utilizing them another year in the manufacture of sugar. I have no shadow of doubt that an amount of sugar could be obtained from these stalks greater in value than the corn which he obtained from them, and he is going to try the experiment. I understand that in Maine last year they canned a million and a half dollars' worth of corn. Now, there was a million and a half dollars' worth of sugar in the stalks, probably not wasted as in Maryland, which might have been taken from the stalks, as I shall show a little further on, and we should have had, as in another case, our cake and eaten it too. Our stalks would have been just as valuable for fodder after we had obtained this sugar as before. Now I see a smile going round among the audience. I have been around among

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three or four audiences of farmers, anxious, as the Irishman said, that some one would "tread on the tail of my coat." I wish any one would trip me in this matter if they can. I am speaking deliberately.

Perhaps I may as well advert to that matter now while it is fresh in your minds. I have here some analyses of two different kinds of sorghums and of corn-stalks. I will tell you what I did with them. I selected a half-dozen stalks of each kind, and then, that there might not be any mistake about it, that I might get a fair average in each experiment, I slit them longitudinally, and I took half of them and put them through a mill precisely as though I was making sugar from the juice; the other half I dried thoroughly without putting them through the mill; and the pressed stalks I dried thoroughly. I also took the leaves from each of those stalks and dried them all. Now, I find that the dried pressed stalks are of equal nutritive value with the dried unpressed stalks, pound for pound. They have not absolutely the same composition, but I will read those things which are by common consent regarded as nutritious — the starchy compounds, the sugar, the albuminoids, and the nitrogenous compounds. I will read first the percentage of sugar in the unpressed and the percentage of sugar in the pressed.

In one variety of sorghum there was 34.73 per cent in the unpressed; in the pressed, 19.36 — more than half as much, you see, of sugar. It ought not to have been there; if I had had a good mill it would not have been there. In the other variety there was 38.14 in the unpressed, 21.77 in the pressed — over 60 per cent as much. In the corn-stalks, 26.001 in the unpressed, 10.008 in the pressed.

Now of the starchy compounds there was in the unpressed, 20.34; in the pressed, 31.46 — 50 per cent, you see, and over, more starchy compounds in the pressed corn than there was in the unpressed, absolutely dry, water free. This was not sweet-corn, but common field-corn. Unpressed, 20.34; pressed, 31.46; unpressed, 17.67; pressed, 26.23; unpressed, 22.44; pressed, 23.16. That is, there is a greater per cent of the starchy compounds in the pressed than in the unpressed. Nitrogenous

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matter — sorghum, unpressed, 4.95; pressed, 3.96; other sorghums, unpressed, 4.81; pressed, 3.87. Corn-stalks, unpressed, 6.90; pressed, 6.04.

Now it is questionable, without calculation, as to which of these would be of the most nutritive value, weight for weight. The other day there was opened at Billerica, Mass., one of those *silos*, where the French process for the preservation of green fodder had been experimented upon, and the last account, if it did not show a complete and satisfactory experiment, seemed to leave no reason to doubt, I think, that it will ultimately be so. But what was done in this case? A crop of corn was raised, it was cut up in the mill, it was packed in the *silo*, and it is now being fed. After the stalks have gone through the mill, and you have obtained all the sugar possible from them, they are in a better mechanical condition, better adapted to go into the *silo*, than they would be if simply cut up. They are in such a condition that I have no doubt (although I have not analyzed the green corn, but propose to do it another year) that their nutritive value is equal to that of the ordinary fodder-corn, and we may in this way utilize this product. That is, we have it as refuse material, having obtained all the sugar we can from the crop.

Now one other point, on which I have but one experiment. I should have tried others if I had not been convinced beforehand that it was going to fail. The result, however, was so surprising to me that I confess I have no longer any opinion in regard to the matter that I am not ready to lay aside within an hour. I planted two rows of ordinary field-corn, white corn, of which millions of acres are grown throughout the South and West. They were all coarse-growing, white dent corns. As evidence of that I would say that the stalks average over a pound and a half apiece. You see they were very coarse stalks. After the crop had ripened, and the husks were thoroughly dead and dry, and the corn could be shelled readily, so that I had a bright, hard, merchantable corn, and I obtained a crop at the rate of sixty-nine bushels of shelled corn to the acre, fifty-six pounds to the bushel, — when we were cutting up the stalks to clear up the field, they seemed so juicy and fresh that I thought

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it worth while to try them for sugar. The next day they were put through the mill, and the best juice, in its contents of sugar, that I obtained from any corn-stalks, sweet-corn or anything else, was that juice which was obtained from those stalks, after a large crop of corn had been taken from them. I have no doubt whatever that this is not an exceptional case, and yet it is in the face of most of the testimony in regard to the matter. I have heard of experiments made as far back as 1840 or 1841, where the stripping of the incipient ears and pulling off the tassels were advised to prevent the formation of ears; but here I had a very large yield, not unprecedented, but still a large yield, more than twice the average in New England, sixty-nine bushels of shelled corn to the acre, and yet I had a juice that was better than any of the other corn-stalk juices that I examined, and which gave me sugar at the rate of about a thousand pounds to the acre. Remember that the sugar-cane of Louisiana gives thirteen hundred and fifty pounds, on an average, though I doubt whether that is high enough, but from that to eighteen hundred pounds; and yet two and a half tons of sugar have been produced from an acre of sugar-cane.

Now it seems to me that these experiments are well worth following out. I have no doubt whatever that we may in this way utilize our corn-stalks. I have no doubt that even where the corn is used for canning, if the stalks were allowed to stand long enough in the field to mature, they would then be in a better condition for working up than they are directly after pulling off the green ears.

I did not intend to take so much time, because I wanted to answer any questions that might be asked on any points that I have not made clear, or upon any which might be regarded as questionable. I have my note-book here, and I can give you the figures for everything. I will say, for the credit of the experiments that have been made, that there has been no guess-work about them. Every foot of ground has been measured, and every inch; every pound of stalks weighed; and the weight and specific gravity of the juice, and the weight of the sirup obtained. Everything has been determined by pounds and ounces, by feet and inches. In regard to the facts, there is no

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question; the only thing is in regard to the practical results. I will say, however, in regard to the corn, that this experiment, although apparently in the teeth of so much testimony, is nevertheless in strict accordance with my results with the sorghum. I found that the juice was at its maximum, so far as the contents of sugar were concerned, when the seed was dry, hard, and ripe; and it raises a very large quantity of seed indeed and it is admirable food for cattle and for poultry; and by analogy I should expect, as I say, that the corn would give the best juice when its seed was hard and dry and ripe. As matter of fact, although it was but one experiment, I regarded it as not exceptional and one of very great importance.

I am much obliged to you for your courteous attention, and I would say that I have here a couple of samples of sugar, one made from corn-stalks and the other from sorghum. They are both sugars of very high grade, will polarize between 90 and 92, I have no doubt, although I have not polarized these particular samples; but if there is any one here who would like to examine them in that respect, I should be happy to let him take samples and satisfy himself that they are, as I said, equal in value to the refiner of the best average ten per cent of the best Muscovado sugars from Louisiana and Cuba.

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FARM EXPERIMENTS.

(THIRD SERIES.)

BY J. W. SANBORN,

MEMBER FROM BELKNAP COUNTY AND SUPERINTENDENT OF THE COLLEGE FARM, HANOVER.

CHAP. I. — EARLY *v.* LATE CUT HAY.

FROM its brevity this experiment would not be reported, were it not accompanied by facts of interest. It is the beginning of an intended prolonged series of researches. The accompanying analyses of early and late cut hay were made from samples of the hay used in these experiments. The analyses were generously furnished me by Prof. S. W. Johnson, as director of the Connecticut Experimental Station. Plat 1 will stand for early-cut hay, and plat 2 for late-cut hay. Plat 1 was cut July 1, when about one-fourth part of the heads were in bloom. Plat 2 was cut July 11, when out of bloom, and after the seed had begun to mature. They had not ripened. Nearly all of the grass was herd's-grass (*Phleum pratense*). A small proportion of witch-grass (*Triticum repens*) and of red-top (*Agrostis vulgaris*) was found. The plats were long and narrow (fifty rods long), and laid out on ground of like fertility and evenness of stand. The narrowness of the plats (one and one-half rods), and the great care in selecting them, give much assurance in the belief that any marked difference in the yield of the plats must arise from difference due to time of cutting. The hay was nicely cured. Plat 2 probably was not so thoroughly dried in the field as plat 1, on account of danger of rain.

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Yield of plat 1 per acre, 3,444 pounds, at housing, and in good order.

Yield of plat 2 per acre, 4,263 pounds, at housing, and in good order.

Yield of plat 1 when fed out, 2,760 pounds; shrinkage, 19.6 per cent.

Yield of plat 2 when fed out, 3,538 pounds; shrinkage, 17 per cent.

FEEDING THE ABOVE HAY.

Lot 1 consisted of two thrifty two-years-old steers, weight 2,044 pounds.

Lot 2 consisted of two thrifty two-years-old steers, weight 2,046 pounds.

Lot 1 fed on early-cut hay.

Lot 2 fed on late-cut hay.

Lot 1 gained in 14 days 41 pounds, and consumed 570 pounds of hay.

Lot 2 gained in 14 days 87 pounds, and consumed 569 pounds of hay.

It will be noticed that the gain of lot 2 is excessive, and may, therefore, not be thought reliable. I will say the conditions were very careful. The lots were of same age and weight, and for twenty-one days previous to experiment were fed alike on corn-fodder and rowen. Both lots having no previous tastes for hay, came to hay with no previous appetites to overcome. They were always weighed before drinking in the morning.

CHANGE OF FOOD. — LOT 2 ON FOOD OF LOT 1, AND LOT 1 ON FOOD OF LOT 2.

Lot 1 gained in 14 days 33 pounds, and consumed 585 pounds of hay.

Lot 2 gained in 14 days 40 pounds, and consumed 706 pounds of hay.

Lot 2 gained more than lot 1, both periods, but decidedly more when fed on late-cut hay. The gain on early-cut hay in excess of the other lot came as the result of increased consumption, requiring 121 pounds of hay in excess of lot 1 to give a

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growth of 7 pounds'; and from all previous experiments it is clear that it is a very poor return for such an excess of consumption. Five pounds should make a pound of growth when eaten as excess-food over maintenance-fodder.

Entire growth from 1,276 pounds of the earlier-cut hay, 81 pounds.

Entire growth from 1,154 pounds of the later-cut hay, 120 pounds.

Pounds of hay, early-cut, required to make a pound of growth, 15.7.

Pounds of hay, late-cut, required to make a pound of growth, 9.6.

Some of the later-cut hay was unfed at the close of this experiment; from its use it became evident soon that in changing from early to late cut hay, the cattle would not eat the latter so readily; but when cattle were put from other foods upon either early or late cut hay, they would eat about as much of the late hay as of the early, and apparently thrive as well upon it.

Lot 1, first period, pounds of early hay to make a pound of growth, 14.

Lot 2, first period, pounds of late hay to make a pound of growth, 6.5.

Lot 1, second period, pounds of late hay to make a pound of growth, 17.7.

Lot 2, second period, pounds of early hay to make a pound of growth, 17.5.

In 1876, Prof. Dimond was the farm manager, and closed haying past the middle of July. In 1877, after an unusually bad season, I closed haying here before the middle of July, getting the hay somewhat damaged; in 1878, I closed haying July 2, getting the hay in very fine order. Each of the three years mentioned I have fed out the hay, feeding each year a nice lot of grade Durhams, two years of age, and weighing very close to one thousand pounds each as they came to the barn. Each winter also the steers have been fed in lots, and the amount of hay consumed and the growth made accurately kept and recorded. I have arranged for comparison the growth per pound of food given for each season. Considering as an element of

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this inquiry the growth per acre of hay, as well as the growth of steer per pound of hay consumed, the comparison is decidedly unfavorable to the early-cut hay of last season.

I do not consider it safe or wise to draw very broad conclusions from these experiments. I am somewhat disappointed in my previous opinions by the facts and observations I have noted. I am convinced by my observation, aside from the weights taken, that we have cut twenty tons of hay less by completing our haying two weeks earlier than formerly. I cannot perceive that in like quantities the hay of this season has been more effective than previously. The only opinion safe to advance is, that, at least for herd's-grass hay, and for growing steers, further facts should be acquired before the advanced views of good authorities in relation to early cutting of hay are generally accepted and adopted in practice. There can be no doubt that there is a great sacrifice in quantity of hay by early cutting; it is not made up in the second crop.

ANALYSIS.

Chemists have assigned a higher theoretical value to early-cut than to late-cut hay. Until comparatively recent dates they have assumed all of the nitrogen of farm products to exist in the form of albuminoids. Late European analyses of roots and tubers show that this is not the fact. Thinking that the fact might be true of grasses that is found true of roots and tubers, namely, that immature plants have a larger proportion of nitrogen in other forms than albuminoids than mature, I applied to Prof. S. W. Johnson, director of the Connecticut Experimental Station, for an analysis in relation to this question. I am indebted to him for the following full analyses of the two samples forwarded him. I will give in connection with his analyses the letter accompanying it; and also, in conjunction with his analyses, one from Wolff's table of very good, not the best, hay. The comparison is interesting.

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	Cut July 1, 1878.	Cut July 11, 1877.	Wolff's.
Water,	8.97	9.29	15.0
Ash,	4.35	4.04	7.0
Albuminoids,	6.56	5.63	11.7
Fiber,	26.95	29.09	21.9
Carbo-hydrates, *	51.07	49.90	41.6
Fat,	2.10	2.05	2.2
	100.00	100.00	

"The analyses have been delayed to ascertain whether or not any part of the nitrogen exists in other forms than that of albuminoids. That question I do not consider as fully settled, but by Lestini's method (precipitation of albuminoids by lead acetate in presence of excess of lactic acid) the total nitrogen is obtained presumably (Lestini believes certainly) as albuminoids.

"The samples are both of them quite inferior to the meadow hay of poorer quality given by Wolff in his tables, which, with 14.3 per cent of water, contains 7.5 per cent of albuminoids. The youngest hay contains but one-half the albuminoids found in *extra meadow hay;* i. e., in that made from well-nourished grasses of the best kinds, cut and properly cured. The analyses are interesting, as showing how grass may disappoint in its quality, for I understand that you supposed the early-cut hay to be quite good.

"S. W. JOHNSON."

I will add in regard to the grass that it was cut from the driest section of the farm (a drift soil and heavy clay, needing drainage), and got in fine order. That it was well nourished will be seen from the fact that the first crop cut over two tons per acre of well-cured hay. There is an opinion, more or less prevalent in this section, that on land of this character hay is not as valuable as on the upland farms. Apparently our cattle thrive very nicely upon it. Farmers calling at the barn frequently ask if we are fattening the steers, — steers that have no other food but hay. I have noticed that they appear to fatten more than to grow. It will be noticed by the analyses that the albuminoids are very low in amount, and the carbo-hydrates very high in amount. Certainly further investigation is needed, and will be given this question. It is worthy of note, that I find the amount of hay required to maintain a thousand-pound steer without growth or loss of weight is less than that reported by German experimenters.

* Non-nitrogenous extract is the proper designation of this 51.07 per cent and 49.90 per cent.

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CHAP. II. — CARDING STEERS.

As before noted, the results of carding steers for the year of 1877–78 were adverse to carding, under the conditions. The experiment was renewed for the winter of 1878–79, with the following results: —

Weight Dec. 16, 1878, lot 1, 2,125 pounds, carded. Lot 2, 1,965 pounds, uncarded.

These steers were taken, one from each of two pairs. They were weighed every fourteen days. Those weights will be omitted, and the weights until change of carding, Feb. 3, 1879, will be given: —

Weight Feb. 3, lot 1, 2,240 pounds; gain, 115 pounds. Lot 2, 2,056 pounds; gain, 91 pounds.

After this date, lot 2 was carded and lot 1 uncarded, in order to note whether the excess of gain of the carded over the uncarded steers was due to carding or the superior capacity for growth of lot 1, as shown by their greater weight at the same age.

Weight of lot 1, April 7, uncarded, 2,395 pounds; gain, 155 pounds. Lot 2, carded, 2,180 pounds; gain, 130 pounds. Total gain of carded steers, 245 pounds. Total gain of uncarded steers, 246 pounds.

These facts, so contrary to prevalent opinion, call for some consideration. The difference this year is practically nothing. Last year the difference in gain of the uncarded steers over the carded was comparatively large. The difference in the results of the two years can be satisfactorily explained by the assumed cause that has led to the greater gain of the uncarded steers. Carding removes hairs, and is said to open the pores of the skin. This facilitates the radiation of heat. If this be the case, its effect on the animal economy can be readily seen. Our stalls were warmer the past year than the year previous. This fact is supposed to account for the different results of carding for the two seasons. If the reason assigned is correct, then the question of carding for growth, irrespective of cost, is ultimately connected with that of temperature. It is my impression, or strong belief, that in warm stables carding will facilitate the growth of cattle. It would appear that an elastic brush of some kind should take the place of the harrowing card.

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Considering that carding of steers increased the radiation of heat from their bodies, it occurred to me that such an effect of carding might necessitate a larger consumption of food. With this point in view as a possible result, I commenced to weigh the food of each one of the four steers in the experiment separately, daily weighing and recording. As each one of the steers gave the same response, I will class results.

Lot 1 ate in 10 days, from Jan. 27, 465 pounds of hay and 40 pounds of grain.

Lot 2 ate in 10 days, from Jan. 27, 398½ pounds of hay and 40 pounds of grain.

Lot 1, being heavier, should be expected to eat more were they not carded. How will it be when we change carding? Will lot 1 when uncarded eat 66½ pounds more than lot 2 when uncarded?

CHANGE OF CARDING.

Lot 1, uncarded, ate in 14 days 553 pounds of hay and 56 pounds of grain.

Lot 2, carded, ate in 14 days 558 pounds of hay and 56 pounds of grain.

This experiment was repeated with the following results: —

Lot 1, uncarded, ate in 14 days, from March 24, 600 pounds of hay and 56 pounds of grain.

Lot 2, carded, ate in 14 days, from March 24, 640 pounds of hay and 56 pounds of grain.

Thus the lighter lot again eat more when carded.

CHANGE OF CARDING.

Lot 1, carded, consumed in 10 days 507 pounds of hay and 40 pounds of grain.

Lot 2, uncarded, consumed in 10 days 464 pounds of hay and 40 pounds of grain.

Carded steers ate in 48 days 2,170 pounds of hay.

Uncarded steers ate in 48 days 2,018 pounds of hay.

It would appear quite strongly, that, in the poorly protected barns of our State, the carder of steers loses his time, that he loses growth of stock, that he loses hay. From a com-

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mercial point of view, it is quite doubtful whether a well-stalled steer, in a warm barn, will pay for harrowing up with a bristling card. Let me not be understood as being opposed to keeping the steer tidy or neat. Let inventors seek for some better instrument.

CHAP. III. — PALM-NUT MEAL FOR BUTTER.

The first cargo of palm-nut meal was brought to this country in 1878. From the favorable opinion of this meal given by Prof. Voelker, of England, coupled with his analysis, I was led to early obtain a supply of it for testing its milk and butter producing qualities. The Bowker Fertilizer Company furnished me with the amount in their hands (two hundred pounds). As has been my custom, I fed two lots, of two cows each, on like foods for a preparatory period, and noted results. Following this period, lot 1 was fed on corn meal and hay, and lot 2 on palm-nut meal and hay. I soon found that the cows would have to be educated to its use. I then added small amounts of palm-nut meal to corn meal. When one cow of lot 2 had learned to eat one-third of the palm-nut meal given, she would then eat more with reluctance, often refusing it. The experiment was so arranged that this result broke in upon the extended method proposed. A like method was then undertaken with the other lot, with similar result as with the first lot. An Ayrshire cow of lot 1 (a good milker, but an unusually poor butter-producer), being a hearty eater, took to the food most kindly. Not having a large quantity for use to fully accustom the cows to its consumption, I resorted to this cow for my test. An experiment so limited may to some not seem worthy of report. A careful examination of the result, I think, will convince most that the indications are such as to warrant our farmers in giving it a careful and observing trial. As the food is new to our market, such indications may be of value.

The thorough-bred Ayrshire cow in our experiment is somewhat remarkable in butter record. I do not consider the results from her, in this experiment, any less valuable on that account.

It may not be uninteresting to note that in the winter of 1877,

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with cob meal for feed, she only gave, so far as shown by the per cent glass, 3 per cent cream.

She was fed in periods of eight days, with the following results, from good hay and 4 pounds clear meal each day: —

Corn meal alone, milk per day 21.14 pounds.

One-fourth part palm-nut meal, milk per day 21 pounds.

One-half part palm-nut meal, milk per day 20.60 pounds.

Three-fourths part palm-nut meal, milk per day 19.60 pounds.

All palm-nut meal, milk per day 20.25 pounds.

Milk set in like conditions for cream: —

Corn meal alone gave 6 per cent cream.

One-fourth palm-nut meal gave 7 per cent cream.

Two-fourths palm-nut meal gave 9 per cent cream.

Three-fourths palm-nut meal gave 10 per cent cream.

All palm-nut meal gave 14 per cent cream.

Setting the milk longer than in the experiment, I got 20 per cent cream. During the previous winter I never with any other food received over 8 per cent cream.

Set for butter, I got the following results from her milk: —

Corn meal gave, for 107 pounds of milk, 2 pounds 7½ ounces, or 43⅜ pounds of milk for one pound of butter.

One-fourth palm-nut meal gave, for 97 pounds of milk, 2.38 pounds of butter, or 40.8 pounds of milk for one pound of butter.

One-half palm-nut meal gave, for 112 pounds of milk, 3.38 pounds of butter, or 33.2 pounds of milk for one pound of butter.

Three-fourths palm-nut meal gave, for 94 pounds of milk, 3.19 pounds of butter, or 29.5 pounds of milk for one pound of butter.

All palm-nut meal gave, for 100 pounds of milk, 4.06 pounds of butter, or 21.3 pounds of milk for one pound of butter.

It would have been pleasant to have had means to observe the butter globules under the change of food. Such a favorable result from change of food is quite remarkable. Having observed the conditions of the experiment carefully, I am convinced that it results from no accidental cause; and conclude that the food is one of promise, and warrants at least careful trying. I consider the quality of the butter to be good from this meal.

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Several other experiments have been undertaken, that are in a state of incompletion.

I have reported several experiments that give to bran a low butter-producing value, and slightly less milk-producing capacity than corn meal. Corn meal has high milk and butter producing qualities, giving a butter of good color, texture, and flavor. From the fact that it can be produced so cheaply in our climate, it does and will take a high rank among dairymen. For several reasons it would appear unsafe to use this feed alone in high feeding. It is quite a general practice to mix bran with it for milch cows. I have been testing other foods, to find one to take the place of bran for the purpose named. Thus far, oats and pease grown and ground together give promise to be better than bran, and, indeed, to prove valuable foods for the butter-cow. They can be easily and cheaply grown by all farmers.

CHAP. IV. — MEAL *v.* HAY.

The comparative value of these two foods is a matter of great practical importance. Various and wide estimates are made by feeders, of their relative feeding value. Chemists have assigned theoretical values to each of these foods. These values have been the only basis for comparison available. That the chemist is not at present able to fix the practical feeding value of cattle-food, is well recognized. In order to obtain a practical standard for comparison of the feeding values of corn and hay, feeding experiments have been continued for two winters. The growth made has been disappointing, and affords a less valuable basis than I desire to see. As was noted in a previous experiment, the coarse hay of rank growth that is produced on the college farm is not calculated for the best growth.

Lot 1, fed hay and corn meal, weight 1,928 pounds.

Lot 2, fed hay alone, weight 2,270 pounds.

Lot 1 consumed, per 1,000 pounds of live weight, daily 22.7 pounds hay and 12 pounds corn meal.

Lot 2 consumed, per 1,000 pounds of live weight, daily 24.5 pounds hay.

Gain of lot 1 for 42 days, 102 pounds.

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Gain of lot 2 in 42 days, 30 pounds.

With meal at $20 per ton, and hay at $10, the cost of keeping lot 1 for 42 days was $5.04 for meal, $9.48 for hay; total, $14.52.

Lot 2, the cost of keeping for 42 days was $11.70.

Value of gain of lot 1, at 4 cents per pound, $4.08.

Value of gain of lot 2, at 4 cents per pound, $1.20.

Lot 1, cost of keep above value of growth, $10.46.

Lot 2, cost of keep above value of growth, $10.50.

The above figures do not represent fairly the value of meal as a supplementary food to hay, for equivalent weights of steer. Assuming steers to weigh 2,000 pounds, and taking the per cent eaten, as above, then lot 1 would consume, in 42 days, 1,906 pounds hay and 504 pounds meal; lot 2 would consume, in 42 days, 2,058 pounds hay.

Thus 504 pounds meal would save 152 pounds of hay, and make 70 pounds more of growth. Total value of hay saved and growth made, $3.56. This value would represent the return for 504 pounds meal, or 70.6 cents per 100 pounds meal, or 39.5 cents for 56 pounds. The direct value (or value of fodder saved and growth made) would make 100 pounds of hay financially as valuable as 70.8 pounds of corn meal; that is, the growth made (at 4 cents per pound) from 70.8 pounds of corn meal would give no better return than from 100 pounds of hay. This statement of the result is not theoretically correct, and is only an approximation to practical values. The increased growth from corn meal gives increased value to the beast, and hastens his maturity. The common practice among farmers in New Hampshire is to fatten steers in the pasture. And as winter growth on thousand-pound steers does not pay, winter food is looked upon as a means to carry steers through to the cheap growth of summer. Viewed from this stand-point, it is seen by the figures of the experiment that corn meal at $20 per ton cannot economically replace hay at $10 per ton. It may be considered that better growth in winter, arising from feeding corn meal, will have further compensation in better growth and selling-value in summer. From other experiments I consider it a very doubtful position to take with reference to the ordinary pastures and methods of grazing in our State. High winter feed must be

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accompanied with the best pastures, or grain in summer to steers in pastures. One experiment settles nothing. In the above experiment, for the amount of hay consumed, I received less return in growth than in any experiment in hay-feeding previously carried out.

The previous experiments were repeated, in 1878–79, with more care, and, unfortunately, with poorer growth from amount of food given than has occurred during any of my experiments. The cattle were thrifty, and had, previous to the experiment, grown well. All the hay was given them that they would consume. I offer the experiments, thinking that for comparison of the value of the two foods they may be of value: —

Jan. 13, lot 1 weighed 2,068 pounds; feed, corn meal and hay.

Jan. 13, lot 2 weighed 2,065 pounds; feed, hay.

Lot 1 consumed in 56 days 2,172 pounds of hay and 446 pounds of corn meal.

Lot 2 consumed in 56 days 2,502 pounds of hay.

Lot 1 gained 69 pounds.

Lot 2 lost 12 pounds.

Change of food, lot 1 on food of lot 2 and lot 2 on food of lot 1: —

Lot 1 gained on hay alone for 56 days after change, 113 pounds.

Lot 2 gained on hay and meal for 56 days after change, 117 pounds.

Lot 1 consumed in 56 days 2,725 pounds of hay.

Lot 2 consumed in 56 days 2,145 pounds of hay and 500 pounds of corn meal.

First period, 446 pounds of meal replaced 330 pounds of hay, or 1 pound of meal .74 pounds of hay.

Second period, 500 pounds of meal replaced 580 pounds of hay, or 1 pound of meal 1.16 pounds of hay.

A comparison of the figures will show that lot 1 in the first period used the meal more largely for growth and less as a substitute for hay than did lot 2 of the second period. Although both lots of steers were of like weights and are of the same age (they had previously grown alike), yet it would appear that one lot had greater capacity for consumption and assimilation than

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the other. These facts hint at an important law to feeders in animal growth.

We have not space nor facts enough to warrant a discussion of the matter. It is clear, however, that an animal that uses concentrated food largely to supplant hay, uses it to a disadvantage.

The steer that is fed to the best advantage is one that directs the excess food thus given to growth; thus lot 1 of first period, at prices previously named, gave in growth and hay saved, over the lot fed on hay alone, for every pound of meal given, 1.1 cents, or a little more than the full value of the meal; while lot 2 on hay and meal only returned over the lot on hay .6 cents per pound of meal given.

Total growth of steers on hay alone for 112 days, 101 pounds.

Total growth of steers on hay and meal for 112 days, 186 pounds.

Consumed, when hay alone was given, 5,227 pounds.

Consumed, when hay and meal were given, 4,317 pounds of hay and 946 pounds of meal.

Thus 946 pounds of meal have presumably replaced 910 pounds of hay, and given a growth of 85 pounds. Estimating hay saved and growth made at prices as before, and 946 pounds of meal have given a return of $7.95, or 84 cents per 100 pounds of meal. At points where hay is $13 per ton and upwards, these figures would indicate that the use of meal at a cent a pound would be profitable practice in place of hay alone. Many experiments are wanted before a just conclusion can be drawn, the individual characteristics of steers varying the results to such a degree; for it will be seen that during the first period of the experiment the meal fed to lot 1 returned a profit for its use, while fed to lot 2 during the second period but about one-half of the value given was returned. I do not think this result should be considered accidental, but rather as one that concerns the animal physiologist.

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CHAP. V. — FEEDING FOR MILK. — SECOND YEAR'S EXPERIMENTS.

First period, all fed alike to obtain relative flow. Time, August. Feed, pasture grass.

Yield lot 1, of two cows, 30.17 pounds daily.

Yield lot 2, of two cows, 30.6 pounds daily.

Yield lot 3, of two cows, 27.5 pounds daily

FIRST CHANGE OF FOOD.

Lot 1 on pasture grass and 100 pounds of fodder-corn, yield daily 30.44 pounds.

Lot 2 on pasture grass and 20 pounds of hay, yield daily 32.44 pounds.

Lot 3 on pasture grass and 9 pounds of corn meal, yield daily 31.55 pounds.

I estimate the cost of the above foods to be about the same when fed out. The fodder-corn had just tasseled. As milk was sold while this experiment was in progress, I could not test the milk for butter. It was all tested for cream by the cream-gauge, but such a test I do not rely upon.

SECOND CHANGE OF FOOD.

Lot 1 on pasture grass and 100 pounds of fodder-corn daily, milk per day, 29.11 pounds.

Lot 2 on pasture grass and 20 pounds of rowen daily, milk per day, 30.44 pounds.

Lot 3 on pasture grass and 9 pounds of corn meal daily, milk per day, 31.44 pounds.

Jersey cow on pasture grass and 4.5 pounds of corn meal daily, milk per day, 15.11 pounds.

The rowen was rather late cut for best results. The fodder-corn during the period was well eared.

THIRD CHANGE OF FOOD.

Lot 1, feed, grass and hay. One cow was off on milk-flow; the others' flow declined from 8⅞ pounds to 7⅝ pounds daily.

Lot 2, feed, pasture grass and 100 pounds of fodder-corn. Yield of milk, 29 pounds.

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Lot 3, feed, pasture grass and 20 pounds of hay. Yield of milk, 29⅛ pounds.

Jersey cow, 50 pounds of fodder-corn and grass. Yield of milk, 13⅞ pounds.

The fodder-corn during this period gave many ears suitable to boil. Each period of feeding covered 10 days. The fodder-corn was from sweet-corn, and thrived nicely, but came up sparsely, giving about one-half of the plants desirable per acre. The first period the fodder-corn was cut from 1,500 feet of ground, the second period from 1,800 feet, and the third from 1,200 feet of ground. The results of these experiments give substantially the same return as in 1877; corn meal first, hay second, and fodder-corn last in value as a milk-producer when used as adjuncts to pasture grass in amounts as above given.

CHAP. VI. — RATIO OF ALBUMINOIDS TO CARBO-HYDRATES.

Experiments in relation to the above question have been in progress for three years. Previous experiments have appeared to make it desirable to feed nitrogenous foods with the coarse foods of the farm, like straw, corn-fodder, and swale hay.

While much time during the past winter has been devoted to this subject, yet time and means that the importance of the subject demands cannot be devoted to it. Doubtless from one to two millions could be added to the value of the products of our farm crops when fed to domestic animals, provided they were more intelligently fed.

German investigators have learned much of the science of feeding. Their results are not before our farmers. The analyses given in these experiments and the results of feeding, aside from abundance of other data, show that we cannot rely on them for information upon which to base accurate practice in our climate and with our soil. In the table accompanying I have condensed six or seven daily weighings of two or three feeding sets. In the case of the cotton-seed and swale hay against good hay, I have condensed the results of changing lots and given the average result. Each lot was made up of two two-years-old

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steers, grade Durhams, and all thrifty, each lot being of nearly equal weight with every other lot.

I am indebted to the department of agriculture at Washington for the accompanying analyses of swale hay, ground meat, and decorticated cotton-seed meal. The department of agriculture is also analyzing other foods in the feeding experiments reported.

The following is the substance of Prof. Collier's report of results: —

	Swale Hay.	Ground Meat.	Cotton-seed Meal.
Per cent of water at 110° C.,	6.41	9.37	8.27
Per cent of organic matter,	87.26	80.66	83.96
Per cent of ash,	6.33	9.97	7.77
	100.00	100.00	100.00

The following amounts of nitrogen were obtained with the corresponding per cent of albuminoids. In the ground meat there were traces of ammonia, but no nitric acid.

	Per cent Nitrogen.	Per cent Ammonia.
Per cent of swale hay,	1.13	7.07
Per cent of ground meat,	8.48	53.02
Per cent of cotton-seed meal,	7.42	46.37

A complete analysis of the swale hay gave the following results: —

Water,	6.41	Gum,	2.67
Ash,	6.33	Oil,	3.63
Albuminoids,	7.07	Celluolse,	21.39
Sugars,	9.12	Amylaceous cellulose,	43.38
			100.00

Under the head of amylaceous cellulose is included that substance, which, after the removal of oil, gum, and sugars, is readily removed by dilute sulphuric acid, and yet which is not common starch. It includes also a substance which is removed from the residue left after treating as above, by a dilute caustic soda solution, and this substance apparently resembles the wood gum "Holsgummi," recently described by Th. Thomsen of Copenhagen.

The analysis of good hay in the accompanying table is from Prof. Johnson, as before noted.

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I have resorted to Wolff's tables for my computations relating to the other foods used.

Lots.	Time in Feeding.	Foods Given.	Amount of Food.	Digestible Albuminoids.	Digestible Carbo-hydrates.	Digestible Fats.	Ratio of Albuminoids to Carbo-hydrates.	Gain.	Cost of Food for Seventy Days.	Value of Straw compared with Hay as Result.	Value of Swale Hay compared with Good.	Manure Value.
	Days.		lbs.	lbs.	lbs.	lbs.		lbs.				
1	70	Swale hay.	2496	79.87	1239	31.20	1 to 5.1	167	$15.04	.....	86%	$12.80
		C. S. meal.	560	207.00	74	49.00						
2	70	Good hay.	3536	146.00	1803	34.00	1 to 12.9	185	21.21	.....	.....	11.36
3	70	Straw.	2423	34.00	971	17.00	1 to 21.3	120	9.53	1.26	.....	4.60
		Corn meal.	347	25.00	237	9.00						
4	70	Oat straw.	2310	31.00	926	16.00	1 to 6.3	81	12.74	.96	.....	8.60
		Meat scraps.	280	134.00	.....	11.00						
		Corn meal.	67	5.00	46	1.70						
5	70	Oat straw.	2450	34.00	982	17.00	1 to 5.8	133	13.88	1.00	.....	9.08
		Blood.	280	151.00	.....	1.40						
		Corn meal.	146	11.00	100	3.70						
6*	77	Clover rowen.	1694	118.00	645	20.00	1 to 9.1	144	12.21	1.65	.....	10 55
		Oat straw.	1309	18.00	525	9.00						
7	56	Clover rowen.	1400	98.00	533	17.00	1 to 8.4	120	5.60	3.00	.....	6.79
		Oat straw.	840	12.00	337	6.00						
8	70	Good hay.	3266	135.00	1666	32.00	1 to 12.9	63	19.59	.....	.....	10.49
9	70	Good hay.	2688	111.00	1118	26.00	1 to 10.5	114	22.03	.....	.....	10.61
		Meal.	591	43.00	403	15.00						

PRICES OF FOODS IN THE ABOVE TABLE.

Meat scraps and dried meat, $45 per ton; dried blood, $45 per ton; straw, $5 per ton; corn meal, $20 per ton; good hay, $12 per ton; clover hay, $12 per ton; swale hay, $6 per ton.

The basis of the column of amounts of digestible food was derived from percentages given by Wolff, as the result of feeding trials.

The corn meal eaten by lots 4 and 5 was for the purpose of teaching those lots to eat their blood and meat.

The amount of digestible materials given for meat scraps is assumed to be about the same as in the case of fish scraps, as given by Prof. Johnson in the report of the Connecticut Experimental Station.

* Average of several experiments of lots of from two to six steers, covering time of from 21 to 77 days; for comparison it is figured in lot of two, as the others.

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Lot 7 was fed clover rowen that I bought for $5 per ton. It was a coarse sample, late-cut. I introduce the result here to show more clearly its value. By estimating the clover rowen at its cost, it will be seen that a pair of steers, weighing 2,100 pounds, were fed for eight cents per day when the food was mixed with straw. At the same time the steers made a very good gain. It cost twenty-eight cents per day to keep a pair on good hay, the steers making only about one-half the growth of those on straw. Of course $5 per ton is an unnaturally low price for clover rowen. I think our farmers do not appreciate its value when rightly fed.

Passing to a just basis of comparison afforded by lot 6, and we find that not only do lot 6 eat less of clover rowen and straw combined than lot 8 do of good hay, but on this lessened consumption they actually gain more and give to straw an actual value much greater than that of hay, as will be seen by the table. This enhanced value of the foods in combination may be ascribed to either the clover rowen or the straw. It properly belongs to both, for the value of both foods is increased by the mixture. The lack of albuminoids in the straw was supplied by the clover rowen, and its carbo-hydrates made available; or it is probably true that the excess of carbo-hydrates in the straw rendered available the albuminoids of the rowen. My experience teaches me that a great saving can be made by the combination of these foods in feeding, and that, as the table indicates, a pound of straw can be made nearly if not quite as valuable as good hay. In fact, in the combinations given, the straw gives a better result than good hay. In the case of lots 3 and 6, a very much better result is afforded. The swale hay also in lot 1 gives nearly as good result in combination with cotton-seed meal as good hay alone. Adding to the swale hay $7.56 worth of the meal, and 2,496 pounds become of nearly equal value with 3,536 pounds of good hay, for growth. The eighteen pounds difference in growth has now a value of seventy-two cents. Subtracting the value of the cotton-seed meal, plus the value of the excess growth of the steers fed on good hay over the growth of those fed on poor hay, and we find the value of good hay that 2,496 pounds of swale hay has taken the place of. In this case it

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would be $12.73, or about fifty-one cents per hundred pounds of swale hay; and, as the good hay was rated at twelve dollars per ton, or sixty cents per hundred pounds, this gives the swale hay, in round numbers, a comparative value of eighty-six per cent of that of good hay. Such hay as I fed is not usually rated at more than from two-fifths to one-half value of good hay. It was largely made up of the round grass abounding in our poorer meadows, that farmers so much dislike.

In every case, the combination of concentrated food with straw or swale hay raised the value of these poor foods.

I have known of no cases of feeding meat to steers, and hence I gave some attention to its use. I did not observe any unfavorable symptoms, either from the use of blood or meat. It would appear from the results of this trial, that, if these fertilizers could be first used as cattle-foods and get in growth their full value as above, and still have the greater part of this food returned in the offal, as is the case in practice, it would manifestly be advantageous to thus use them, provided that feeding of matter of this character was not followed by disaster to the health of the steer.

A study of the ratio of albuminoids to carbo-hydrates does not seem to give any pronounced indications. The addition of corn meal to straw gives, as heretofore, very much better results, it is true, than when added to good hay; but the ratio of corn meal and straw, 1 to 21.3, gives as good results as very much closer ratios. One thing is very clear by the table, that an immense sum could annually be saved in this State by proper combinations of our foods. I wish in particular to call the attention of our farmers to the great value of clover hay and rowen, to feed in connection with straw, swale hay, and corn-fodder.

It will be noticed that an estimate of the manure value of the foods given has been inserted in the table. The time has come in the history of our agriculture when the manure value of foods should be considered in purchasing for consumption on the farm.

The values given have been taken from a table of the manure value of foods, arranged by Gilbert and Lawes. It makes allow-

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ance for the material of the food likely to be taken up in growth and otherwise lost. For the poor hay, blood, and meat, I have assigned values that may be considered as only approximations. In fact, an accurate value cannot be assigned to them. Considered as an approximation only, it is hoped that this column may be useful. This column, considered as so much credit in favor of the foods given, will quite materially change the values of the foods as they would otherwise appear by the table.

I have said that "the ratio of albuminoids to carbo-hydrates (in the table) does not seem to give any pronounced indications." This appears to be true so far as the nutritive ratio is concerned, but when the absolute amounts of albuminoids and carbo-hydrates consumed per day per steer are considered, the indications of the table are more pronounced; the gain of steers following more closely the increase or decrease of carbo-hydrates, and is apparently nearly independent of the supply of albuminoids.

Lot.	Total carbo-hydrates consumed per steer per day.	Total albuminoids consumed per steer per day.	Total fats consumed per steer per day.	Gain per steer per day.
	lbs.	lbs.	lbs.	lbs.
1.	9.08	2.05	.57	1.19
2.	13.05	1.06	.24	1.32
3.	9.07	.42	.18	.87
4.	7.42	1.21	.20	.57
5.	8.10	1.40	.15	.95
6.	8.05	.86	.18	.93
7.	8.25	.98	.20	1.07
9.	11.06	1.10	.30	.81

Lot 3 returns ordinary gains with only .42 pounds of albuminoids per day. The growth was steady throughout the period of feeding, and as great a per diem gain was given as they had previously been making. Could it be safely assumed that their gain in chemical composition was similar to the gain of the steers analyzed by Lawes (seven to eight per cent albuminoids and sixty to sixty-five per cent fat), then it would appear that the fats and albuminoids combined in this ration would be quite

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insufficient to account for the increase without assuming that other carbo-hydrates were converted into fats. As the facts upon which the table is based are not sufficient to warrant very broad conclusions, it may be dismissed by the observation that an ordinary gain is made by less albuminoids than has been thought sufficient by German investigators. The gain in question per day for the period, is less than for the first fifty days. During the month of April the gain was small; but was not peculiar to the steers in question, being noticed in the entire stock of cattle (fifty head), and has been observed to be less in April, for three years past, than in previous months.

It will be seen that the best hay grown on this farm will give, by Prof. Johnson's analysis, a nutritive ratio of 1 to 12.9, being deficient in available albuminoids and rich in carbo-hydrates. From three years' experience in weighing, aside from results in the table, it is seen that an average gain of one pound a day can be obtained with it when fed to a thousand-pound steer. Wolff's table would make such a ration only capable of sustaining live weight without work or growth.

Prof. Johnson, in his translation of German work in the report of the Connecticut Experimental Station, gives as the requirement of a seven-hundred-pound steer per day, 1.4 pounds digestible albuminoids and 9.1 pounds of carbo-hydrates; ratio, 1 to 8. This amount is required to grow such a steer 150 pounds in 180 days. As herbage is the product of soil and climate, and cattle of all three, may not these factors have an influence on the nutritive ratio required in this country?

CHAP. VII. — CHEMICALS FOR POTATOES.

It will be remembered that the past year fifty-six plats were laid out carefully for permanent experiments, twelve of which were devoted to chemicals for potatoes. This, therefore, is the second year of potatoes on the same plats, each plat fertilized as before. The soil is a firm alluvial clay, free from rocks, flat, and undrained. It is not adapted to potatoes, particularly so when they are not planted on sod-land. These facts seem, however, not to have militated against the value of the relative

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results. The plats contained eight square rods of land, being two by four rods, each plat separated from others by vacant spaces.

The bone-black used contained fifteen per cent phosphoric acid; the sulphate of ammonia, twenty per cent nitrogen; the muriate of potash, fifty per cent potash. Potatoes in the table are valued at forty cents for table, and fifteen cents for small potatoes.

The drouth early in the growth of the tubers affected the crop to some extent, otherwise the season was favorable for potatoes. Paris green was used to destroy the potato-bug. Apparently the green injured the tops and shortened the period of active life.

These lots were designed partly for the purpose of plant-analysis of the soil, to gather what hints we might for guidance in fertilization on this farm, and hence in large part can have in part only local value, the great diversity of soils and seasons forbidding special formulas even for a stated crop. The averages of a great number of seasons and many tests on critical classification of soils will undoubtedly enable the production of a general fertilizer for potatoes closer to the needs of this crop than is now produced. I think, however, that this experiment has some points of interest to the public.

They will aid in giving an approximate knowledge of the value of chemical manures alone for the growth of crops, and, the plats being laid out permanently, a knowledge of their permanent effect on the soil. This point may be of more importance than would be recognized at first thought. The world-renowned experiments of Gilbert and Lawes have now been continued for nearly forty years, and are now the subject of study in this country. From them many deductions have been drawn and applied with much assurance to our climate and soil, quite too hastily I think. The humid air of England gives less evaporation of water into the air. This fact in connection with their open winters gives rise to a very much heavier percolation of water into the subsoil, and consequently a very much increased loss of soluble plant-food, especially of nitrates. In Gilbert and Lawes' experiments the amount of applied fertilizers recovered in crops rarely approached fifty per cent of that applied,

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and in the case of yard manure only fourteen per cent, although in the case of yard manure under unfair conditions. For the two years of the experiments reported it will be seen that eighty-eight per cent was recovered in crop, presenting an encouraging fact.

A second point of interest is the proportion of nitrogen recovered each of the two seasons of the experiment. Last year sulphate of ammonia returned a profit when used in what is termed a full-formula amount. This season in no case, with one exception, does the ammonia used affect the crop for good, and in that case the per cent returned in crop was not so large as last year, while with the minerals a large increase of the per cent recovered is seen. In plat 4 the two minerals costing only two dollars and eighty cents give as good returns as plats 1 and 3. In plat 1 the ammonia cost four dollars and ninety-two cents. But this matter, of so great importance to agriculture, I shall refer to again in reporting the results with corn and wheat, where a wider range of fertilizers are used. Suffice it now to say, that the minerals alone give as large an increase as could have been expected had the supplied ammonia been efficacious; and that where the minerals were used singly last season, as in plats 9 and 11, no increase from their use was then noted; and that last season nitrogen was effective. This season, when the potato-crop appears to secure its nitrogen from natural sources, these single-mineral plats give a large increase over the nothing plat. This would appear to show that the season had very much to do with the nitrogen supply required. I wish to call attention to the fact that second year's use of chemicals on the same plats gives a larger increase over the nothing plats than last year's, and their use is quite profitable.

It will be noticed that potash is most efficacious on this farm for potatoes. I think this fact does not occur from the large amount of potash required for this crop. Experience seems to teach in many instances that phosphoric acid exerts a more controlling influence on the growth of this crop than either of the other materials. Prof. Voelker thus finds it. It is not found in practice that that element which occurs in plants in most abundance is most needed in fertilization. In this case I am of the

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YIELD OF POTATOES WITH DIFFERENT FERTILIZERS.

Plats.	Fertilizer Used.	Furnishing.	Yield of Table Potatoes.	Yield of Small Potatoes.	Total Yield.	Yield, 1878.	Yield over Nothing Plat, 1879.	Yield over Nothing Plat, 1878.	Per cent Fertilizer returned, 1879.	Per cent Fertilizer returned, 1878.	Cost of Fertilizer.	Value of Yield over Nothing Plat.
			bushels	bushels	bushels	bushels	bushels	bushels				
1	105 pounds sulphate of ammonia, 73 pounds of bone-black, and 68 pounds muriate of potash	21 pounds nitrogen, 11 pounds phosphoric acid, and 34 pounds potash	96	48	144	206	88	87⅓	88	87⅓	$7.72	$35.65
2	Nothing		6	50⅓	56⅓	122⅔	..	..	..	..	...	....
3	52½ pounds sulphate of ammonia, 73 pounds of bone-black, and 68 pounds muriate of potash	10½ pounds nitrogen, 11 pounds phosphoric acid, and 34 pounds potash	95	46⅔	141⅔	192⅓	85⅓	69⅔	85⅔	69⅔	5.29	35.03
4	73 pounds bone-black and 68 pounds muriate of potash	11 pounds phosphoric acid and 24 pounds potash	107⅔	49	156⅔	174⅔	100⅓	52	100⅓	52	2.80	40.40
5	105 pounds sulphate of ammonia, 36½ pounds bone-black, and 68 pounds muriate of potash	21 pounds nitrogen, 5½ pounds phosphoric acid, and 34 pounds potash	114	53⅓	167⅓	188	111	65⅓	111	65⅓	7.09	41.25
6	105 pounds sulphate of ammonia and 68 pounds muriate of potash	21 pounds nitrogen and 34 pounds potash	70⅓	57⅓	127⅔	198⅓	19	18⅔	19	18⅔	6.45	8 50
7	Nothing		47⅔	61	108⅔	179⅔	..	..	..	..	...	....
8	105 pounds sulphate of ammonia, 73 pounds bone-black, and 33 pounds muriate of potash	21 pounds nitrogen, 11 pounds phosphoric acid, and 17 pounds potash	85⅓	50⅓	135⅔	220⅓	27	40⅔	27	40⅔	6.86	13.47
9	73 pounds bone-black	11 pounds phosphoric acid	46	50⅔	96⅔	121⅔	40⅓	1*	40⅔	..	1.27	15.95
10	105 pounds sulphate of ammonia and 73 pounds bone-black	21 pounds nitrogen and 11 pounds phosphoric acid	23⅔	37⅔	61	121	4⅔	1⅔*	4⅔	..	6.25	5.03
11	68 pounds muriate of potash	34 pounds potash	57⅓	47	104⅓	132⅔	54⅓	10	54⅓	10	1.53	20.50
12	108 pounds sulphate of ammonia	21 pounds nitrogen	47	47	94	164⅓	37⅔	41⅔	37⅔	41⅔	4.98	8.20

* Loss.

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opinion, founded upon experiments here, that this soil is relatively wanting potash, although a clayey one, and would suggest that those farmers cultivating river or alluvial lands, would do well to experiment a little with potash salts. The hill farmers of this town have very much more faith in superphosphates than the river farmers.

The wide difference in yield of the two nothing plats may need or call for an explanation. The plats number from west to east and plat 8 is the extreme easterly plat, plat 9 beginning on the end of plat 1 and running east again; thus plat 10 joins the nothing plat 2. Plat 5 is nearer plat 7 than plat 2, and seems probably to be on richer ground; as also do 6, 7, and 8 than do the other eight. The land is very uniform in character, and any difference is due to previous culture, of which I am not informed back of 1873. The increase of plats 6 and 8 are compared with 7, thus getting satisfactorily relative yield, excepting plat 5, which is compared with plat 2, and may not be considered as very valuable. These differences will be largely eliminated in after years. In fact, the difference is less than last year. I noticed this difference in plats to warn others from drawing very broad conclusions from single-year experiments without a profusion of nothing plats.

CHAP. VIII. — CORN-RAISING.

The first crop adopted in a rotation is corn. Thinking that it may not be entirely uninteresting to the public, I forward a statement of methods pursued and the results. It has been customary for me to use twenty-eight loads of manure (forty-bushel carts) to the acre. Believing that with the use of machinery hoed crops are more profitable than grass, and that chemicals rightly used are profitable, I used less manure per acre and chemicals to fill the place of manure withdrawn. I had manured one acre as heretofore, before the change was made. Sixteen acres were planted to corn and manure saved for other crops. The ground is a heavy clay needing drainage, a few acres of which have never been planted to corn. At least one-half of the field is considered as poor corn ground. The wetter

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portion of the field was plowed in beds, thus obtaining surface drainage.

CORN FIELD.	DR.
Two-fifths cost for man, horses, and oxen at $4.50 per day for 13 days	$23.40
Three harrowings, Randall harrow, man, pair of horses and harrow	15.00
Man, pair of horses, and smoothing-harrow, 1 day	2.50
Man and horse, 1½ days planting	3.37
Man and pair of horses, 1¼ days dragging corn (or hoeing)	3.75
Man and horse, two harrowings corn, 3 days	5.42
Man and horse, twice cultivating and once hilling, 71 hours	13.26
Man, 1 day planting over	1.25
Seed corn, 3¾ bushels	3.75
Weeding, 12¼ days' work, last of July	15.31
Stooking, 40 days' work	50.00
Drawing in and mowing butts, 30 days	30.00
Ox-work drawing in, 8 days	5.00
Husking 2,390 bushels of 40 pounds to a basket at 4 cents	95.60
One acre to 28 loads of manure of 1 ton each, drawn and spread at $1.60, — one-third of	14.93
Twelve acres to 14 loads of manure of 1 ton each drawn and spread at one-third of cost	89.60
Two-fifths of 150 bushels of ashes spread, 3 acres	18.00
One hundred pounds of sulphate of ammonia, 100 pounds of dissolved bone-black, 40 pounds of muriate of potash, and 60 pounds of fine ground bone, — $8.94 per acre, 13 acres	116.22
Chemicals as above for 3 acres, except potash omitted, — $8.06 per acre	24.18
Mixing and applying fertilizer, 9 days	11.25
Total	$541.79

CORN FIELD.	CR.
Sixteen acres fodder, 56 tons at $6	$336.00
Shelled corn, 1,125 bushels, at 75 cents	843.75
Valuation	$1,179.75
Deducting cost	541.79
Balance for use of land	$637.96

EXPLANATIONS.

I charge only two-fifths cost of breaking to corn, holding that a part of the costly breaking of the sod properly belongs to crops in a following rotation, they getting much benefit from the

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thorough tillage given corn, each after plowing being cheap. Previous to drawing corn I charge man one dollar and twenty-five cents per day. The farm being practically in the heart of a village, our labor costs more than on most farms. Horses and oxen are a part of the farm capital and should never be considered as costing more than interest on cost, — cost of keeping and depreciation. I have included one horse for sixty-two cents per day.

The planter used was a two-rowed planter, made in this State by Hon. Moses Humphrey. The harrow used was the Thomas smoothing-harrow constructed for the purpose. I should have used it three times and the cultivator but once. The drag was a home-made one generally used for fining lumps. It was used just as the corn was breaking ground and before the harrow was used. The free use of these implements named, including cultivator, kept the ground mulched during the drouth, and thus prevented evaporation. The corn was planted in hills twenty-two inches apart and three kernels in a hill, rows three and one-half feet apart. I used the Ross implements of cultivation and hilling.

Two-thirds of the fertilizer was spread broadcast, with much care to get it even. The balance was strewn in a band the entire length of the drill after planting and before dragging. It is to be noticed that three acres were to ashes and chemicals alone. Where the ashes were put I omitted the muriate of potash. These three acres were very much run down, not having been plowed for a very long term of years. The crop was very heavy on these three acres, averaging as good as the rest of the field.

The pulling of weeds is not a very large bill but an entirely unnecessary one. My use of drag, harrow, and roller (roller in place of drag on part of the field) was wholly experimental with me. When the implements named are correctly used no weeding will be needed.

The cost of spreading ashes and fertilizers I shall nearly dispense with another season by a horse-power distributer.

The crows took out one-fourth of an acre; one-half acre gave less than one-half yield. Years ago some one spread a heavy coating of sand on nearly an acre and then plowed it into such

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narrow beds that much subsoil was turned up. The corn was very poor on this section.

The corn-fodder weighed four tons per acre on a lot I weighed. It was then in a condition to pack down in a mow. I have made deductions from this, as will be noticed. The corn stood one month in the stook and dried very much during the dry time that followed cutting up. As will be noticed, I still make a more liberal deduction than usual, eighty-five pounds of ears for a bushel. I consider the thorough tillage given, coupled with the use of the planter, to have aided in giving a somewhat more than average crop.

Allow me to suggest that the interest of our farmers demands that their fields should have a thorough fit for machinery; that large loose rocks thrown up by the plow and harrow should be picked off before planting. After this let me suggest that a disc harrow be used. A planter run deep should be used to put corn in right for machines to follow. Just as the corn begins to prick the ground go lengthwise of the row with a roller. Follow this every five to seven days with a Thomas smoothing-harrow until corn is six inches high. Then follow with a light-running cultivator; run close to the hill so as to spray the dirt among the stalks. Finish off with a light hiller to smother weeds that may have escaped. Such cultivation is worth far more than hand-hoeing, and when backed with a liberal supply of chemicals, and top of yard manure, gives a fair profit in the culture of our grand corn-crop.

The estimated value of stover will be criticised by some as high. From experimental data in proper combinations with other food, I consider the value low excepting in locations in the northern counties where hay is now very cheap. It is worth six dollars per ton in any part of the State, and more in some parts. As to the price of corn, I have sold some for eighty cents at eighty pounds to the bushel.

CHAP. IX. — FERTILIZATION OF SOILS.

I will repeat that our soil is alluvial, undrained, clayey soil; that the same plats are to be kept continuously to the same crop

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and the same fertilizer. This is the second year's crop of corn. I have found that corn on this soil does not follow corn successfully. The season was cold in the spring, and backward and dry during the formation and early development of the ear. These adverse influences checked the early maturity of the corn. Anticipating a frost it was cut up the 24th of September, before it was injured by the very early and severe frost. The corn on the more successful plats was well matured, and, considering the character of the season and the general result of the crop last year in this State, the product is satisfactory for experimental inquiry. Those who have taken an interest in the experiments will understand the purpose for which they were designed, and will remember that many of the plats were not intended for profit, but are calculated to shed some light upon the proper plant-food for this farm.

Allowing five dollars per ton for freight, the chemicals are estimated to cost on the farm as follows: For sulphate of ammonia, four and three-fourths cents per pound; for muriate of potash, two and one-fourth cents per pound; and dissolved bone-black, one and three-fourths cents per pound. Last season eighty pounds of ears of corn were estimated to make a bushel of corn; this season eighty-five pounds are allowed for a bushel. The corn was well dried in the stook, and, as the ear lightens in the process, it will be seen that less has to be allowed for shrinkage. The plats are two by four rods. The results will be given at the rate per acre. Corn is calculated at eighty cents per bushel, and forty cents for eighty-five pounds of soft corn. Stover is rated at six dollars per ton; well worth it when combined with the right food.

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RESULT OF THE DIFFERENT FERTILIZERS.

Plats.	Materials Used.	Furnishing.	Yield, Sound Corn.	Yield, Soft Corn.	Total Yield.	Yield, 1878.	Yield over Nothing Plat, 1879.	Yield over Nothing Plat, 1878.	Cost of Fertilizer.	Value of Corn.	Value of Corn and Stover.	Value of Increase, Corn and Stover.	Stover.	Stover to Bushel of Corn.
			bush.	bush.	bush.	bush.	bush.	bush.					lbs.	lbs.
28	186 pounds dissolved bone-black, 128 pounds muriate of potash, and 320 pounds sulphate of ammonia.....	31 pounds phosphoric acid, 67 pounds potash, and 64 pounds nitrogen.....	29.4	16.4	45.8	69.0	17.0	38.0	$21.33	$34.53	$45.28	$18.61	5400	118
29	186 pounds dissolved bone-black, 128 pounds muriate of potash, and 240 pounds sulphate of ammonia.....	31 pounds phosphoric acid, 67 pounds potash, and 48 pounds nitrogen.....	44.7	16.4	61.1	65.0	32.3	34.0	17.53	42.32	62.84	36.17	6640	109
30	186 pounds dissolved bone-black, 128 pounds muriate of potash, and 160 pounds sulphate of ammonia.....	31 pounds phosphoric acid, 67 pounds potash and 32 pounds nitrogen.....	50.6	14.0	64.6	53.3	35.6	22.5	13.73	46.08	64.68	38.01	6200	96
31	186 pounds dissolved bone-black, 128 pounds muriate of potash, and 80 pounds sulphate of ammonia.....	31 pounds phosphoric acid, 67 pounds potash, and 16 pounds nitrogen.....	55.5	13.5	69.0	48.0	40.2	17.0	9.93	49.80	68.70	42.03	6300	91
32	186 pounds dissolved bone-black and 128 pounds muriate of potash.....	31 pounds phosphoric acid and 67 pounds potash...	52.5	15.2	67.4	37.0	38.6	6.0	6.13	47.84	62.20	35.53	4800	71
33	186 pounds dissolved bone-black, 64 pounds muriate of potash, and 320 pounds sulphate of ammonia.....	31 pounds phosphoric acid, 33½ pounds potash, and 64 pounds nitrogen.....	38.8	14.0	52.8	...	24.0	...	19.89	36.64	48.04	21.37	3800	74
34	Nothing.....	.....	12.4	12.8	25.2	...	...	...	....	15.04	25.54	....	3500	138
35*	180 pounds dissolved bone-black and 320 pounds sulphate of ammonia..	31 pounds phosphoric acid and 64 pounds nitrogen..	....	...	...	...	...	...	18.45	....	2.10	24.57†	700	...
36	93 pounds dissolved bone-black, 128 pounds muriate of potash, and 320 pounds of sulphate of ammonia...	15½ pounds phosphoric acid, 67 pounds potash, and 64 pounds nitrogen..	13.6	17.1	30.7	...	1.9	...	19.71	17.72	25.52	1.15†	2600	84
37	128 pounds muriate of potash and 320 pounds sulphate of ammonia..	67 pounds potash and 64 pounds nitrogen.....	14.5	19.7	34.2	...	5.4	24.5	18.08	25.28	38.18	11.51	4300	122

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38	208 pounds Charleston mineral phosphate, 128 pounds muriate of potash, and 320 pounds sulphate of ammonia	62 pounds phosphoric acid, 67 pounds potash, and 64 pounds nitrogen	15.0	11.5	26.5	61.0	2.3†	30.0	19.71	22.60	32.80	6.13	3400	129
39	186 pounds dissolved bone-black	31 pounds phosphoric acid	15.0	18.1	33.1	55.5	4.3	4.5	3.25	19.24	29.44	2.77	3400	102
40	Nothing		20.2	13.8	34.0	35.0	5.2	...	....	21.68	32.78	6.11	3700	109
41	128 pounds muriate of potash	67 pounds potash	47.3	16.6	63.9	59.5	35.1	28.0	2.88	44.48	56.48	29.61	4000	62
42	320 pounds sulphate of ammonia	64 pounds nitrogen	15.0	16.9	31.9	36.2	3 1	5.2	15.20	18.76	37.06	10.30	6100	191
44	16 tons yard manure	Estimated to contain twice the material of plat 28	90.1	9.0	99.1	62.8	70.3	31.3	28.00	72.44	185.44	78.77	11000	111
44½	Nothing		8.7	16.2	24.9	..	...	...	....	13.44	20.88	....	2480	99
47	Baltimore silicated phosphate	Nearly the same as plat 32	36.2	12.7	48.9	...	20.1	...	....	34.04	51.02	24.37	5660	111
48	160 pounds magnesia, 80 pounds salt, and 120 pounds lime		8.7	12.5	21.2	43.8	7.6†	...	....	11.96	20.78	5.89†	2940	134
49	1,000 pounds decorticated cotton-seed meal	— phosphoric acid, 33.6 pounds potash, and 74.2 pounds nitrogen	35.3	14.1	49.4	...	20.6	...	16.00	33.88	54.58	27.91	6900	139
50	140 pounds bone meal, 128 pounds muriate of potash, and 300 pounds sulphate of ammonia	31 pounds phosphoric acid, 67 pounds of potash, and 64 pounds nitrogen	22.7	16.9	39.6	...	10.8	...	19.93	24.92	37.22	10.55	4100	103
51	Nothing		1.83	12.8	31.1	31.0	...	...	....	19.76	27.56	....	3600	115
54	40 bushels ashes		4.09	9.9	50.8	38.0	22.0	7.0	10.00	36.68	55.28	29.61	6200	121

* No yield practically. † Loss.

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OBSERVATIONS.

One of the most striking and important results brought out by the table is the relation of the ammonia salts to the crop, and its contrast to results of last season. Last year an increasing quantity of ammonia salts gave an increasing crop up to the largest amount used in plat 28; and everywhere where used, on all plats, both to corn and potatoes, in connection with minerals, gave a large increase of crop for its use, and a profit for use up to three-fourths formula, or amount used in plat 29, notwithstanding its very high cost. This season wherever used it brings a loss, excepting a very slight gain for one-fourth part as in plat 31 over 32, but not a profitable gain. Plat 42 gives, it is true, a little more than the average of the nothing plats, but not so much as plat 40 near to it. And I may add here as a very interesting fact, apparently, that plats 40 and 31 represent probably the true native fertility of the soil for the season better than 34 or 44½; for 34 and 44½ were fallow for the season of 1878, while the others bore heavy crops for unmanured land. I have other facts that in a future paper I shall allude to, that go strongly to show that the bare fallow was, at least so far as this season's crop is concerned, an injury. If my conclusions are right, the experimental land is of rarely uniform fertility; the two bare fallowed last year agreeing nearly in crop, and the other two that bore a crop corresponding very close in yield. The plats run in rows of nine, parallel to each other; thus the nothing plats are well interspersed among the fertilized plats.

But to return to the ammonia plats. I observed that the stalks were not so vigorous as those to minerals alone, or minerals and a slight quantity of ammonia salts, and were, as my record shows, an easy prey to worms. Why this result? Is it due to the quality of the ammonia? No; because the minerals alone gave as good crop as could have been expected had the ammonia salts been added with complete success, as in plats 41 and 54 and 32. In 32 only potash salts were used to give theoretically forty-three bushels of increase of crop of corn, yet without any ammonia 38.6 bushels of increase was made. Now the same plat gave but six bushels of increase over nothing plat last year. So of ashes and other mineral plats; they gave but

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little or no increase both on corn and potatoes over nothing plats, while this year they give as good results as last year when ammonia salts were profitably used. Neither was it due to ammonia salts left over in the soil; for the mineral plats had no ammonia salts, and in case of those plats that did have a liberal use of them the increase of crop was so heavy as to absorb nearly all of these salts. Nor is it due to any carelessness of mine, or to a local influence; for I put out several experimental sets in different sections of the State and on diverse soils, and the results come to me the same. I would call particular attention to this point, because no question in fertilization is at once so difficult and important to fathom. Last year, in round numbers, twelve dollars' worth of ammonia salts paid a profit for use. This year they are worse than useless, and are over one half of the cost of fertilization for an acre of corn; yet had they not been used last season but little increase of crop (six bushels) would have been harvested. I can only say that I believe that the character of the season has more to do with the ability of a plant to gather its nitrogen from natural sources than has been generally recognized, and that at present science does not explain it fully, nor can we at present combine fertilizers for seasons. We may, however, accept the averages of several seasons as the safest mean. It would appear to me to be prudent for the time to use about one-half of what has come to be known as full formula of nitrogen for corn. By comparatively recent experiments of Berthelot and others, it appears that the electrical condition of the atmosphere has much to do with the power of a plant to gather its nitrogen nourishment from the natural source, the air, and that that condition is quite variable in different seasons and in the same season.

DISSOLVED OR UNDISSOLVED PHOSPHATES.

The objects of 37 and 50 are thwarted by the heavy use of ammonia salts, with the results noted. One-half quantity of these will be used in the future, in the endeavor to ascertain the most economical form in which to apply phosphoric acid.

Plat 47 was treated with a fertilizer containing no nitrogen. The makers of this fertilizer consider its character as such that

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it does not involve the need of nitrogenous matter. It was received from the Board of Agriculture and used by request of Hon. J. O. Adams, its secretary. The record of the quantity used has been lost, but I remember to have put on, as near as its composition would admit, the amount that would give as much potash and phosphoric acid as I put on plat 32. While the makers have been subject to much criticism, the results of the experiment, on account of the peculiarity of the season, should not be considered as adding any facts to the case other than it is not apparently a cheap source of minerals for this farm, requiring, as it does, much potash.

The results with the cotton-seed meal I hope all will note. It was added for the express purpose of showing the utility of buying food rich in fertilizing matter for feeding. Compare with 32 to minerals.

The relation of the fertilizer to the proportion of corn to stalk will pay to peruse. The nitrogen alone gave an enormous growth of stalks, — one hundred and ninety-one pounds per bushel of corn. Next in order comes phosphoric acid. The potash gives a very light proportion, — sixty-two pounds per eighty-five of dried corn and cob.

POTASH THE MANURE OF THE CROP.

It will be noticed, on comparison of plats, that the presence or absence of potash affects the crop more than either of the other materials. This same result has been noticed here for the three years of my observation, both on the plat work and in the main field. The fertilizers ordinarily put upon the market containing no potash would thus be of little use on this farm, and this is the experience of my neighbors up and down the river on land of the character of this farm. I respectfully suggest that if they would use potash salts with superphosphates, that more satisfactory results would probably be obtained. I can fertilize now to far better advantage than before these experiments, and would suggest to all farmers that a few such plats might be of very good advantage to them.

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PROFIT IN USE OF FERTILIZERS.

It will be noticed that where the two minerals are used, and even where one-half quantity of ammonia is used (as it should be for the present), the use of chemicals is quite profitable when repeated the second year even. It is frequently said plat work represents but little of value for larger field work, because plats receive so much attention. Excepting much care to get exact measurements of ground, fertilizer, and crops, my plats have not had as good culture as the main field crops. The constant use of implements on the main field gave me really better results than received on plats. No weeds springing up with the chemicals, only two hoeings were hastily made by hand, when much more was done where machinery could be used during the drouth to check evaporation of water. I should say that the ground was thoroughly prepared for the plats, but the same with field crops. Although soils vary, I see no reason why others, with equal care in buying and applying, cannot get as good results substantially as I have. If so, then their enlarged use by our farmers is to be earnestly commended. The fertilizer was two-thirds broadcast and one-third drilled in corn row (not put in hill). The plat to yard manure had twenty-eight tons per acre last year.

I wish to repeat the caution before given, that the good results of the potash here may not be expected on the hill farms. Prof. Hitchcock, to whom I suggested that the clayey farm ought to contain potash in abundance, and considering its fineness of particles is in more than ordinary available condition, on his part suggested that as potash is somewhat easily soluble in water, when the land was deposited by its action its potash was dissolved out in a measure. From reports of experiments to me by farmers, and from personal observation, I am convinced that generally phosphoric acid will accomplish more on the hill farms than potash, although the indications are that, generally, one-half proportionate quantity at least of potash should accompany it.

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CHAP. X. — PREPARATION AND METHODS OF APPLICATION OF MANURE.

In 1877, twenty loads per acre of forty bushels each were applied to thirty square rods and plowed under. A like amount was applied to thirty square rods of like land and harrowed in; soil, alluvial clay; season, favorable for the oat-crop. As the ground was moist and flat it was sown rather late for a good oat-crop. The growth was rank, and, as generally occurs on this land, the oats lodged. Not likely to fill well, being badly lodged, they were cut for fodder; surface-applied gave 1,685 pounds of fodder, and on the plat where the manure was plowed under 1,785 pounds were harvested. I was disappointed in the result, as the plat surface-dressed looked thirty per cent larger in bulk, and was of larger bulk. Being exhausted ground the plat surface-dressed came up first, and from the same amount of seed much thicker, as it had immediate plant-food. It was more advanced in growth during the most of the growing season, and of finer stalk because thicker. As a plant approaches near to maturity its water-contents diminish. Having observed the growth of the crop and knowing that the weight was accurately taken, in my disappointment I ascribed the difference of product to difference of water-contents, arising, not from dissimilar degree of curing, but of maturity. Unhappily, I had no means of testing chemical composition.

In 1878, after removing the fodder-oats, grass-seed was sown and a good mat of grass got. This was done without disturbing the position of the manure, the lot that was first plowed down remaining unmoved seven inches deep. The ground being flat the young grass was slightly winter-killed, and, though but little difference in result was observed, no weights were taken, fearing that the results might not be absolutely reliable.

In 1879, crop even in both plats. Surface-manured gave 745 pounds, or per acre 3,966 pounds. Plowed-under gave 715 pounds, or per acre 3,813 pounds.

This year I laid out two more permanent plats of 1-20 an acre each; 1,760 pounds of sheep manure was applied to the surface of one (plat 1), and harrowed in. The same amount of cheep manure was plowed under as well as might be on stubble-

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land for plat 2; crop, oats, to be seeded to grass. Plat 1 gave at rate per acre of 4,300 pounds of straw and 1,580 pounds of oats. Plat 2 gave at the rate per acre of 5,700 pounds of straw and 1,260 in oats. The straw of plat 2, as before, was coarser than from plat 1. The great difference in weight of straw was exaggerated by weeds that came in as the result of more tardy and less full start of oats on this plat. The straw was heavier on this plat 2, however. Two other plats were also started to corn. As in practice, manure plowed under is plowed up the next season, or if put on top is plowed under, these plats were intended for annual application and culture. Sixteen hundred pounds of manure were applied to each. That plowed under gave per acre, stover, 9,120 pounds; good corn, 4,880 pounds; and soft corn, 860 pounds. Surface-applied gave 9,040 pounds of stover; good corn, 5,980 pounds; and soft corn, 740 pounds.

The general results thus far seem to indicate that the manure plowed under on this soil favors development of fodder, while more favorable results in grain are realized by surface-applying manure.

FERMENTED *v.* UNFERMENTED MANURE.

Size of plats as before, and by test last year known to be of like fertility; 1,600 pounds (rate of sixteen tons per acre) manure was taken from behind a given number of animals one day. The same feed being continued, the next day 1,600 pounds of manure was gathered from the same stock as before. Thus we start with like manure. One lot was fermented until its weight was reduced to 1,357. I intended to ferment it very much more, but miscalculated as to the time required, not putting it up soon enough. Both lots were put in a good, tight, dry place. The unfermented manure gave 11,000 pounds of stover, 7,660 pounds of good corn, and 760 pounds of soft corn. The fermented gave 8,200 pounds of stover, 5,620 pounds of good corn, and 860 pounds of soft corn. Of such astonishing results I can only say that they are taken with accuracy and represent the actual difference in product, and that good corn-growers frequently say that they prefer raw manure for corn. That such a result will occur again, or on other crops, I do not dare to say. I simply mean to know and give the result.

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BARE FALLOW.

Four plats last season, of dimensions accurately the same, were fertilized at the rate of twenty-eight tons in round numbers of good manure. Two of them grew crops of nearly identical amounts, and the other two were accidentally fallow. This season the four plats were treated with like amounts of weighed manure, sixteen tons per acre. One of the former fallow plats was treated the same as one of the plats that bore a very heavy crop last season. Thus there was the manuring for two crops for the fallowed ground. I looked for a more luxuriant crop on the fallowed ground, at least in its vegetation. The result was as follows: Ground with previous fallow (cultivated some, weeds kept down) gave 9,040 pounds of stover; good corn, 5,980 pounds; soft corn, 740 pounds. Ground with crops both years gave 11,000 pounds of stover; good corn, 7,660 pounds; soft corn, 760 pounds. From reasons better than general opinion I am satisfied that both plats were, previous to last season, of very similar crop capacity. As noted in my last, the chemical plats have given me corroborative evidence that fallowing is of doubtful utility, at least where the soil is ordinarily fertile. Lawes and Gilbert have shown that fallowing is exhaustive of soil fertility. As no one, perhaps, in New Hampshire fallows, the point would hardly be worth attention were it not for the fact that it is occasionally recommended and is somewhat practiced in the Middle States.

MANURE FROM FOOD.

The manure from cattle that was weighed to ferment was taken from behind forty-three head of cattle, — calves, one year old, two years old, and three years old. This weight may be considered an average result, for, on weighing, the second day it required forty-four head instead of forty-three only to make the 1,600 pounds. The fodder given to a very large proportion of this stock was daily weighed for the entire winter. Of those whose food was not weighed, I have records from experiments on the farm of amounts of food eaten in winter by animals of like weight and age. From these figures, by careful computation, I find that they ate 734 pounds of hay, straw, and grain.

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The amount eaten will vary but a few pounds from these figures. From a month's weighing of water drank by four two-years-old steers, I judge that, in round numbers, an animal will drink in cold weather with dry food about two pounds of water for one of food eaten. On this basis, given simply as an approximation for the benefit of any that may feel an interest in it, the animals ate and drank 2,202 pounds. Now of this estimated 2,202 pounds taken into the system of the forty-three cattle, 1,600 pounds were gathered up from behind them in an ordinary plank trench. No liquid was taken up more than what was held by the manure, and no more than the manure would hold. Of the 602 pounds unaccounted for, very much would be thrown off by the lungs as carbonic acid and exhaled from the skin. Very much of the remaining portion (urine) would undoubtedly be taken up by the manure-heap in the cellar beneath the cattle, for it did not appear to be at the point of saturation.

If these figures at all represent ordinary conditions, as I suppose they do, my only inference is that there is far less liquid waste from ordinary cellars even without absorbents (for none was used in the case stated) than is popularly represented.

From observations of the cellars on this farm I am satisfied that only a small loss is made, but presume that that loss will well pay interest for concrete bottoms to manure-pits that shall be water-tight at the bottom and on the sides for a foot up. That matter I desire to test here very carefully another season. That I may not be misunderstood, I will be pardoned for adding that I do not in my statement contemplate a case where the manure is thrown out to the action of rain, or stalls very leaky where the urine runs speedily through without opportunity of being taken up by manure on floor or in cellar, and that I do not present it as a designed and complete experiment, but as a fact noted in the previous experiments that may not be without interest.

CHAP. XI. — VALUE OF FOODS.

I inclose the third annual report of experiments in pig-feeding, made not for the purpose of ascertaining how rapid or cheap

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growth could be obtained, but rather to test the comparative feeding value of the different foods employed. If they had been managed for the express purpose of rapid and cheap growth, better results undoubtedly should be obtained. The pigs used were the ordinary stock of the neighborhood. From better-bred pigs better results might be expected. As the results obtained are better than estimates usually made, I name the above facts as encouraging evidence that pig-raising, as a source of cheap and valuable manure, should receive more of the attention of our farmers. If it can be shown that manure can be obtained for attendance on pigs, then by purchase of foods and rearing of pigs an unlimited amount of manure is at cheap command.

Four lots of two pigs each were fed. The pigs were all from one litter. After feeding a fortnight to wean and accustom to grain, they were weighed at six weeks of age, and put into lots; lot 1 of 62 pounds, feed cob meal; lot 2 of 62 pounds, feed clear corn meal; lot 3 of 61 pounds, feed middlings; and lot 4 of 60 pounds, feed meal and middlings in equal parts by weight. Thus we have fair conditions for an experiment: eight pigs of one litter, in lots of similar weights and well weaned. They were a cross of a Poland China boar on a grade Chester White sow. The cob meal fed is but part of a series of experiments (commencing with cows for milk and butter) to determine the value of cobs in cob meal from whole ears of corn.

Lot 1 consumed for 50 days, 318 pounds of cob meal and 286 quarts of skim-milk; gain, 131 pounds.

Lot 2 consumed for 50 days, 337 pounds of clear meal and 286 quarts of skim-milk; gain, 135 pounds.

Lot 3 consumed for 50 days, 304 pounds of middlings and 286 quarts of skim-milk; gain, 146 pounds.

Lot 4 consumed in 50 days, 247 pounds of middlings and corn meal, and 286 quarts of skim-milk; gain, 118 pounds.

Assuming, from previous experiments with pigs of the same age, that it requires twelve quarts of skim-milk to make one pound of growth, and subtracting the growth thus made from total growth, and we have the following figures for the grains given, viz.:—

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Lot 1, growth per 100 pounds of food, 33.6 pounds; cost per pound of growth, 2.34 cents.

Lot 2, growth per 100 pounds of food, 32.9 pounds; cost per pound of growth, 3 cents.

Lot 3, growth per 100 pounds of food, 40.1 pounds; cost per pound of growth, 2.5 cents.

Lot 4, growth per 100 pounds of food, 38 pounds; cost per pound of growth, 2.6 cents.

The cob meal is rated at eighty cents per hundred pounds, and the meal and middlings at one cent per pound. It was cheaper at the commencement of feeding and higher at the close. I bought mostly before the rise, and sold the pigs before the rise in the price of pork, or for four cents per pound, live weight.

CHANGE OF FOOD

to ascertain whether the difference in growth was the result of kind of food or the character of the pigs. The skim-milk was continued during thirty-two days of this period, and then withdrawn for other purposes. It was given at first because I had no other purpose for it. Its presence in the food would affect slightly the proportions of flesh, fat, and heat formers. Yet the change of food would check the slight difference that would occur, or it would place each lot under the same relative foods.

Lot 1 consumed in 32 days, 272 pounds of clear meal and 193 quarts of skim-milk; gain, 79 pounds.

Lot 2 consumed in 32 days, 280 pounds of cob meal and 193 quarts of skim-milk; gain, 78 pounds.

Lot 3 consumed in 32 days, 299 pounds of meal and middlings and 193 quarts of skim-milk; gain, 100 pounds.

Lot 4 consumed in 32 days, 245 pounds of middlings and 193 quarts of skim-milk; gain, 87 pounds.

Estimating as before (allowing sixteen quarts of skim-milk for one pound of growth), and from grain: —

Lot 1 grew per 100 pounds of food, 24.6 pounds; cost per pound of growth, 4.1 cents.

Lot 2 grew per 100 pounds of food, 23.5 pounds; cost per pound of growth, 3.4 cents.

Lot 3 grew per 100 pounds of food, 29.4 pounds; cost per pound of growth, 3.4 cents.

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Lot 4 grew per 100 pounds of food, 30.6 pounds; cost per pound of growth, 3.3 cents.

Average gain per 100 pounds cob meal, to date, 28.5 pounds; average cost, 2.9 cents per pound.

Average gain per 100 pounds clear meal, to date, 28.7 pounds; average cost, 3.5 cents per pound.

During the next fifty days of feeding, one pig in the cob-meal lot was crippled in his hind legs so that he did not eat well. He recovered so that during the fattening period, when both lots were fed on corn meal, either lot gained very nearly exactly alike per pound of food eaten. His trouble cannot be ascribed to cob meal. This lot will be dropped from the list.

THIRD PERIOD.

Feed as before excepting skim-milk omitted: —

Lot 1, feed corn meal for 49 days, ate 425 pounds; gain, 98 pounds; gain per 100 pounds of food, 23 pounds; cost per pound, 4.3 cents.

Lot 3, feed meal and middlings for 49 days, ate 470 pounds; gain, 133 pounds; gain per 100 pounds of food, 28.3 pounds; cost per pound, 3.5 cents.

Lot 4, feed middlings for 49 days, ate 489 pounds; gain, 115 pounds; gain per 100 pounds of food, 23.5 pounds; cost per pound, 4.2 cents.

This is the first instance in three years of experiments in pig-feeding when meal and middlings mixed gave better results than middlings alone, and this only for one of the three weighings. Again, at no time has the difference in favor of middlings over meal been so slight. The period following this, all of the lots were fed on corn meal for fattening, and this lot that had had middlings did worse comparatively than on middlings; one of the lot crippled and fed light, gaining nothing; and, although they had eaten well previously, or during the period just figured, yet it would seem that the cause that resulted in the disease of his limbs had previously impaired his digestive or assimilative organs.

Average gain from first period to date per 100 pounds of corn meal, 28.6 pounds; cost per pound of gain, 3.8 cents.

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Average gain from first period to date per 100 pounds of middlings, 31.4 pounds; cost per pound of gain, 3.3 cents.

Average gain from first period to date per 100 pounds of meal and middlings, 31.9 pounds; cost per pound of gain, 3.16 cents.

If the last period is excluded the middlings will stand first.

Average gain for 3 years per 100 pounds of middlings, to grow a 200-pound pig (live weight), 28.4 pounds.

Average gain for 3 years to grow a like pig per 100 pounds corn meal, 26.1 pounds.

I should name that Northern corn instead of Western was fed this year, and that the difference is also less between the values of middlings and corn meal. When it is considered that the manure from a ton of middlings is worth twice as much as from a ton of corn meal, the advantage of using middlings for growing pigs will stand out stronger. The average for the three years shows middlings to be nearly nine per cent more valuable for growing pigs than Indian meal. I am satisfied that middlings are not less than fifteen per cent more valuable than Western meal, as food for the growing pig. The superior value of middlings for pig-growth, it seems to me, is now sufficiently shown.

The striking advantage of feeding the cobs of the corn ground with the grain needs further investigation. It should be stated that fourteen pounds of cob meal were added to fifty-six pounds of corn meal.

FATTENING PERIOD.

Lot 1, weight 450 pounds; gain for 29 days, 80 pounds; consumed 347 pounds; gain per 100 pounds of food, 23 pounds.

Lot 2, weight 415 pounds; gain for 29 days, 75 pounds; consumed 318 pounds; gain per 100 pounds of food, 23.4 pounds.

Lot 3, weight 530 pounds; gain for 29 days, 90 pounds; consumed 389 pounds; gain per 100 pounds of food, 23.1 pounds.

They were all fed on corn meal (Western for this period). These figures serve to show the uniform capacity of the lots for growth.

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Since writing the above I have seen the results of an experiment by a committee of two farmers' clubs of Connecticut, in feeding cob meal against clear meal, that fully corroborates my results with these two foods; also an indirect corroboration of it by Prof. W. Stewart in feeding pigs cut clover in small quantities, mixed with meal. Both experiments as reported appear to have had careful management. The good results of Prof. Stewart's experiment with clover and meal against meal alone were ascribed to the effect of clover as a divisor of the meal, thus preventing the impacting of the meal in the stomach and allowing the free access and action of the gastric juice. Cob meal would, in a measure, perform the same office. Many recent analyses of cobs by several American chemists have been made, and they all concur in finding a heavy per cent of digestible carbo-hydrates in them. I will give the results of the experiments by the farmers' clubs. Four and three-fourths pounds clear meal made a pound of shote; 4.63 pounds cob meal, or, reduced to clear meal, 3.70 pounds, made a pound of growth. A bushel of clear meal made 12.90 pounds of growth, and the cob meal that it would require to make a bushel of clear meal made 15.11 pounds of growth. Estimating the growth from 100 pounds of food, and the clear meal made 21 pounds and the cob meal 21.5 pounds. Comparing these figures with the growth received, and a great difference in favor of the college-farm pigs is seen. It is the difference in favor of a young pig over a shote for economy of growth. This point should never be lost sight of by the feeder. These corroborative experiments go strongly to prove that cob meal can be fed to great advantage to pigs. I propose, however, to continue the experiments until proof is satisfactory. Some suggestions occur that will better bear review when the proof is clear beyond question.

CHAP. XII. — DAIRY MANAGEMENT.

I submit the following results of experiments in relation to influences of temperature on animal products and amount of food-consumption. During the winters of 1877 and 1878 the milk-flow of the cows was daily kept; also the daily temperature

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of the atmosphere. An unmistakable influence of temperature on the milk-flow was observed, the milk-flow rising and falling in amount almost in exact proportion to the rise and fall of the temperature. The per cent of change in the milk-flow was in proportion to both intensity and duration of change. It was seen that for short fluctuations of weather, there was a change in the amount of production rather than in the amount of consumption by the animals. To maintain the heat of the system in colder days, instead of consuming more food, the animal diverted a part of the food from consumption for the purpose of maintaining heat. Such would not be the effect of long duration in the change of temperature, in all probability. The facts referred to have been published, and I will not review them.

Wishing to obtain further data, and more definite, I have kept two cows in cased stalls, and two in an open barn. The cased stalls were made simply by boarding, as is getting common, the stable up separately from the floor of the barn. This was done nicely with matched boards and tight-fitting doors. A means of ventilation was provided. The same fact that was previously observed has been noticed with both the cows in cased stalls and those out or in open barn ; namely, that a change of outside temperature was followed very closely by a change of milk-flow. Thus the milk-flow of both lots of cows averaged, from Dec. 9 to Jan. 2, 56 17-23 pounds of milk a day, and the average temperature of the two stables 56.3°. From Jan. 2 to Feb. 3, the milk-flow was 59 3-32 pounds, and the temperature, 39.6°. There was four per cent increase of milk-flow for 3.3° change of temperature, notwithstanding less milk would have been expected, everything else being equal, for the cows were one month farther removed from calving. The kinds of foods given had not been changed, nor their amounts. The coarse foods they ate at their pleasure. It has been noticed that in our barn in open stalls a change of one per cent in the milk-flow follows for every degree of temperature variation when the change is continued for a month. This fact might not follow in barns where outside temperature maintained a different relation to its inside than is seen in the college-farm barn. I have some facts that seem to corroborate this view. There were other cows in the

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cased stalls than those named, and, although the temperature fluctuated with the outside temperature, yet the fluctuation of the milk-flow of these cows was not nearly as much as those on the outside of the stalls; in fact, their fluctuation of milk-flow was very slight, and hardly traceable to weather changes. It would require too much space to give the figures, as they would require some explanation. Such, however, is a plain fact of the figures carefully kept and compared. From the statement it would seem that the temperature of the stable was apparently high enough for the best results. The average of night and morning for nearly three months was 45.1°. I have nothing to show whether or not this temperature may not have been too high, but I judge that it was not, and if so, but slightly too high. If a stable is to be warmed by animal heat, or by the animals in it, very high, it has to be so tight as to prevent proper ventilation. Without proper ventilation the good effects of high temperature are lost. When a cow goes into the yard for drink and exercise, she suffers more from out a warm stable than from a cold one. That matter can be adjusted, however. A warm stable could be had by artificial means and good ventilation at one and the same time; but here comes the question of profit. Will it pay? These are questions for the future. In the meantime, our farmers should remember that up to, or nearly up to, the temperature named, I have found it profitable to keep the temperature up by stables so tight that the animals will warm it. Ventilation is provided rudely in this case.

To come to the experiments in question; four cows were divided into two lots of two each. Each lot was fed alike for the entire time. Both lots were kept in cased stalls for eleven days, to get their flow of milk under the same conditions.

Lot 1 gave, per day, 30 9-10 pounds.

Lot 2 gave, per day, 30 8-11 pounds.

Second period, lot 1 in open barn; yield per day for 28 days, 28 7-23 pounds.

Second period, lot 2 in cased stalls; yield per day for 28 days, 28 10-23 pounds.

The gain in milk-flow in favor of the cased stalls is, in this instance, only three-fourths of one per cent.

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Lot 1, pounds of milk required to make a pound of butter, 29.5.

Lot 2, pounds of milk required to make a pound of butter, 20.5.

Average temperature for this period, — from Dec. 9 to Jan. 2, — morning and night in open barn, 28.3°.

Average temperature for the same period in cased stalls, 44.4°.

Lot 1 consumed in 23 days, 638 pounds of hay and 815 pounds of corn-fodder, and 5 pounds of corn meal daily.

Lot 2 consumed in 23 days, 627 pounds of hay and 825 pounds of corn-fodder, and 5 pounds of corn meal daily.

The cows were exchanged places from Jan. 2, lot 1 being put in cased stalls, and lot 2 in open barn.

Lot 1 weighed, Jan. 2, 1,955 pounds.

Lot 2 weighed, Jan. 2, 1,840 pounds.

Lot 1 consumed to Feb. 3, or 32 days, 852 pounds of hay and 802 pounds of stover, and grain as before.

Lot 2 consumed to Feb. 3, or 32 days, 967 pounds of hay and 905 pounds of stover, and grain as before.

Lot 1, milk per day, 31 3-32 pounds; milk required to make a pound of butter, 33.2 pounds.

Lot 2, milk per day, 28 pounds; milk required to make a pound of butter, 21 pounds.

Weight of lot 1, Feb. 2, 1,990 pounds; average temperature of open stalls, 32.6°.

Weight of lot 2, Feb. 2, 1,875 pounds; average temperature of cased stalls, 46.7°.

The change of milk-flow is very considerable during this period, and amounts to 11.3 per cent in favor of warm stables. The amount of food consumed has suffered a radical change. Where there was but one pound difference before, we now note a consumption of 218 pounds more by cows in open barn. I had conjectured that the amount of butter from a given amount of milk might be less in cold weather than in warm. The figures above taken do not corroborate this view. The result may, from some unseen reason, be accidental. Care was taken in method of setting, temperature, temperature of churning, etc., to have the two lots of milk and cream from them carried to butter under precisely similar conditions. The weight of the cows do not seem to have been affected by conditions of temperature.

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Lot 1 in open barn, milk per day for 21 days, 27.5 pounds.

Lot 2 in cased stalls, milk per day for 21 days, 28.5 pounds.

As the milk during this period was all sold, it being term time, I had no opportunity to set for cream, but tested for cream by cream-gauge, under very nice conditions, and found I got less cream in cased stalls. I do not rely upon the cream-gauge. The result, however, corresponds with the butter test before. Also I found a change in weight in favor of the open stalls. Temperature of open stalls, 33°; of cased stalls, 44.2°.

Lot 1 consumed for 21 days, 635 pounds of corn-fodder, 635 pounds of hay, and meal as before.

Lot 2 consumed for 21 days, 628 pounds of corn-fodder, 628 pounds of hay, and meal as before.

It will be noticed that lot 1 is again, in this period, in the open stalls, and lot 2 in the cased stalls as at the first test, and also that the relative milk-flow and food-consumption are as they were at first test. These figures corroborate the correctness of the difference noted after the first change and those taken for previous winters, particularly in regard to effect of temperature on milk-flow.

In putting the pair of cows from warm to cold quarters they lose, and in putting the other pair from cold to warm quarters they gain. The gain per pair will then be but one-half of the amount noted per two pairs, and one-fourth per cow. Ignoring the relation of temperature to weight of beast and quality of cream, because as yet too uncertain to base calculations upon, and calculating the saving of food and milk per cow upon the basis found, and we have a saving of 2.8 per cent of milk per day and .8 pounds of stover and .9 pounds of hay. Calculating the milk at three cents per quart, stover at six dollars per ton, and hay at twelve dollars per ton, and we have a daily saving of one and one-third cents per cow, providing the cow gives an average of fourteen pounds of milk per day. This saving for one hundred and twenty of our coldest days amounts to one dollar and sixty cents. The cost of casing up stalls, as I have named, is but a very small sum. The saving gives an exceeding good interest on money thus invested. The winter was very mild. The difference may be expected to be more in an

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ordinary winter. The saving would pay the expense the first winter.

CHAP. XIII. — CO-OPERATIVE EXPERIMENTAL WORK.

I desire, through the ordinary channels of communicating the experimental work of the college farm to our farmers, to solicit their co-operation in experimental work with chemical fertilizers, that a better knowledge of the wants of our soil may be more rapidly obtained, that we may quickly and more clearly settle, in the general conviction of our farmers, the question as to whether chemical manures can be used very generally at a profit; and, if so, what and how to buy. I am convinced that if the individual farmer knew better the wants of his soil, or what to buy, how to buy and how to use, that chemical fertilizers could be used to great advantage if their use is coupled with thorough and thoughtful cultivation. I am anxious that one hundred farmers, or upwards, should select a plat of ground of as even quality as possible, and divide it into at least ten plats of two by four rods, separating each plat by a vacant space of four or five feet, to be kept clear of weeds and all growing vegetation. Upon plat 1 use thirteen and one-half pounds of dissolved bone-black, containing two pounds of phosphoric acid. Let plat 2 have no fertilizer, to ascertain the natural yield of the ground. On plat 3 use thirteen and one-half pounds of dissolved bone-black and seven and one-half pounds of muriate of potash, potash salts, containing four pounds of potash. Plat 4 same as plat 3, and in addition six pounds of sulphate of ammonia, containing one and one-fourth pounds nitrogen. Plat 6 same as plat 4, excepting in place of dissolved bone-black substitute eighteen pounds of bone meal, and, as the bone meal will contain some nitrogen, instead of six pounds sulphate of ammonia only use four pounds. Plat 7 same as plat 4, except substitution of a mineral fertilizer for dissolved bone-black. Plat 8 same as plat 4, as a duplicate plat. Plat 9, nothing. Plat 10, one ox-load of forty bushels of good manure. Plat 5, which I have accidentally omitted, same as plat 4, using instead of six pounds sulphate of ammonia twelve pounds sulphate of ammonia.

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OBJECT OF EACH PLAT.

At the present point in the history of chemical fertilization it will be needless, with intelligent farmers, to go very minutely into the purposes sought by the combinations, or the direct relations of the materials used to the growth of the plant. In brief, the belief resting upon wide experimental data has become general, that, of the materials that enter into the growth of a plant substantially, all soils and the air furnish all but three in abundance. These three are phosphoric acid, potash, and nitrogen. Again, it is found that some soils do not need, for a long series of years, added potash, and in some instances phosphoric acid is not needed when potash is; also that some plants can gather all their nitrogen from natural sources, like clover, while others can get a part, and some, like wheat, but little.

As far as experiments have been carried in this country in the growth of corn, it has been seen that not one-half, perhaps not one-third, of the nitrogen in a given crop need be added to the soil in order to make that crop. The importance of this fact may be seen when it is remembered that the nitrogen in a crop of corn would cost nearly three-fourths as much as all the materials in a full formula, or more than twice as much as the minerals; or the minerals in fifty bushels of corn and its stalks would cost only about six dollars, while the nitrogen would cost nearly fifteen dollars. If but one-third nitrogen is needed, the cost of fertilizing is cut down ten dollars per acre. Again, if your soil needs no potash, or only one-half the quantity, the cost is still further reduced. I have grown on this farm, with less than three dollars' worth of potash, at the rate of sixty-two bushels of corn per acre and five thousand pounds of stover, without yard manure.

Plat 1 will inform us whether phosphoric acid can be profitably used. Plat 3 with added potash will enable us to note whether potash increases the crop over plat 1, and, if so, whether profitably. Plat 4 with added nitrogen will give us an idea of the gain by its use over the two minerals of plat 3. Plat 5 is for the purpose of ascertaining whether an increased use of nitrogen over the amount used in plat 4 can be profitably used. It would be desirable to add still another plat with a higher pro-

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portion, but it would so enhance the cost of the sets as to restrict their use, and, furthermore, the facts at hand are so strong that the inquiry will be useful if narrowed to two proportions.

The substitution in one plat of bone-black and in another of mineral phosphate for dissolved bone, is for the purpose of noting the comparative value of these sources of phosphoric acid to the plant. Its importance will be seen when it is remembered that soluble phosphoric acid costs about twice as much as in the form found in bone meal, and three times as much, or more, than in mineral phosphates. The subject is being investigated very thoroughly in Europe, and much discussion has occurred upon the matter during the past winter in England and Germany. Recent facts seem to show that there is not nearly as much difference in value as has been heretofore assumed, and on some soils practically no difference. It would appear that the character of the soil has much to do with the economic results of the subject in question. An investigation of this matter may prove of much economic value to us as farmers. The object of the duplicate fertilizer plat and nothing plat, also of yard-manure plat, will be clearly seen.

SOME FACTS.

I cannot occupy space reviewing individual cases gathered from the best of sources. Suffice it to say that my own experiments, many that were returned to me last year from sets put out by me, those that have been returned to Prof. Atwater, and individual cases that I have learned in lecturing to our farmers and those of Vermont, have returned in weighed products more crop for the chemicals than for the yard manure. I have learned of a multitude of cases where potash has paid remarkably for use (our superphosphates contain little or none as put upon the market, and hence often fail and undermine the faith of farmers in fertilizers).

A multitude of cases occur where plain superphosphate pays as well, or rather gives substantially as much crop, as where the other materials are added. I speak of facts (not conjectures), and these facts furnish good reasons for these co-operative experiments; for while they give to the experimenter more knowl-

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edge of his own farm and more definite information as to the results of each of the different materials used, they also allow of rapid collection of facts and a more speedy settlement of this important question of chemical fertilization. Each experimenter has the advantage of all the experiments of all the others. Working together we can settle in the popular mind in one or two years that which will require ten or twenty-five years of careless effort. I would not be understood to mean that we are going to settle any great question, but forward the practical solution of uncertain questions, and familiarize ourselves with the question of purchase and use of the pure chemicals.

SMALL-PLAT EXPERIMENTS.

Small-plat trials have been sharply criticised as being of uncertain answer. The best investigators of Germany, Scotland, England, and France use them and commend the practice. They assert that with plenty of nothing plats and great accuracy, small plats for comparative results are better than large areas. Plats of one-half acre each would extend over so much ground that a greater diversity of soil would occur. I propose that two-by-four-rod plats be used, and that the ten plats be arranged in parallel rows of five beds, or plats, each; thus the entire ten plats will make nearly a square, or eight rods by ten rods plus the interspaces to prevent the corn from feeding across into neighboring beds.

CHAP. XIV. — ROOT-FOOD.

For three years past I have devoted some time and attention to experimental work in roots, feeding with the same care that was bestowed upon the experiment that I have to report upon. The results were somewhat disappointing, when measured by a popular notion among many of their high feeding value. The value heretofore returned has been but slightly more than six cents per bushel. The roots heretofore fed have been both turnips and mangel-wurzels; but principally the former. Knowing, or thinking, that the beet was better adapted to our soil, and a richer food, when properly grown on a clay soil, than tur-

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nips, I grew, last summer, or summer of 1879, a fine crop of mangel-wurzels, solid, and of even and not especially rank growth, giving at least sixty tons per acre. These roots were grown from seed of a well-known farmer, and had been bred with an especial reference to a medium-sized, nutritious root. These roots were fed to both cows and steers, and results carefully noted. I will condense the important facts noted.

Lot 2 of two cows ate in 27 days 55 pounds mangels daily, and 712 pounds hay and 870 pounds stover for the period.

Lot 1 of two cows ate for the above period, no mangels, 670 pounds hay, and 847 pounds stover.

Lot 1 gave per day for these 27 days, 39 pounds milk.

Lot 2 gave per day for these 27 days, 39.6 pounds milk.

Lot 1 made from 196 pounds milk, 6 7-16 pounds butter.

Lot 2 made from 203 pounds milk, 5 10-16 pounds butter.

CHANGE OF FOOD. — LOT 1 ON FOOD OF LOT 2, AND LOT 2 ON FOOD OF LOT 1.

Lot 1 consumed for 31 days 800 pounds hay, 805 pounds stover, and 55 pounds mangels daily.

Lot 2 ate for the above period 893 pounds hay, 866 pounds stover, and no mangels.

Lot 1 gave 37.7 pounds milk daily for 31 days.

Lot 2 gave 37.4 pounds milk daily for 31 days.

Lot 1 made from 188 pounds milk, 5 11-16 pounds butter.

Lot 2 made from 158 pounds milk, 5 15-16 pounds butter.

BOTH LOTS ON SAME FOOD.

To fix more certainly the effects noted, both were put on the same food, and milk-products noted. This result will furnish a better or fuller basis upon which to estimate the returns from the roots.

Lot 1 consumed for 16 days 450 pounds stover and 480 pounds hay.

Lot 2 ate for 16 days 462 pounds stover and 495 pounds hay.

Lot 1 gave 39 11-16 pounds milk per day.

Lot 2 gave 38 5-16 pounds milk per day.

The change of milk-flow after the first change of food

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amounts, after striking the balance between the two lots, to 1.45 pounds of milk per day, worth 1½ cents. The change in fodder-consumption amounts to 18 cents in value for 31 days; rating hay $10 per ton, and stover $5 per ton. As to the gain in butter, it appears very strongly to be on the other side, as the figures very emphatically indicate: —

Lot 1, no mangels; 30.4 pounds milk make one of butter.

Lot 2, fed mangels; 36 8-9 pounds milk make one of butter.

CHANGE OF FOOD.

Lot 1 on mangels, requires 37 pounds of milk to make one of butter.

Lot 2, no mangels, requires only 26.5 pounds of milk to make one of butter.

I may apologize for the large amount of milk required by these cows for a pound of butter. They are not selected as butter-makers. The milk is sold, and good milk it is, too, for family use. In the above figures an average of 8½ pounds, or more than 29 per cent, more of milk is required to make a pound of butter from the mangel-fed cow. These figures look too wide for ready acceptance. I can only say that the milk was set by one method, and handled under like conditions. After witnessing or performing the work, I am quite sure that the roots in question affected the butter-producing quality of the milk. Then, so far as results of the first change of food are seen, they are very discouraging. In fact, the roots for butter bring us in debt with all labor thrown in. I may say that these roots were fed commencing with Dec. 22.

SECOND CHANGE OF FOOD.

During this change the lots were both on the same food, and by withdrawing the food of roots the relative flow of milk changed but a fraction of a pound of milk per day; and the food made a more marked change, amounting in a period of 31 days to 65 pounds of hay and 67 pounds of stover, valued at 49 cents, milk at 1 cent per day added, gives a saving of 80 cents for 28½ bushels of roots, as 55 pounds per day were fed. From this must be deducted a probable loss of quality in milk for butter

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purposes. No test of the milk was made, as for the time being all milk was sold. A test by the cream-gauge would be so uncertain that none was made. I have made several short but interrupted experiments with different roots and the potato for milch cows with similar results in previous years. Those experiments have not been published, although one or two were quite complete.

ROOTS FOR STEERS.

Lot 1 of two steers, weight 2,350 pounds, fed mangels, etc.

Lot 2 of two steers, weight 2,598 pounds, food contained no mangels.

Lot 1, weight Feb. 16, or at the expiration of 49 days, 2,463 pounds.

Lot 2, weight Feb. 16, or at the expiration of 49 days, 2,694 pounds.

Lot 1 ate 60 pounds of mangels daily, and 147 pounds of cob meal, 1,334 pounds of stover, and 1,472 pounds of good hay for the period.

Lot 2 ate 147 pounds of cob meal, 1,610 pounds of stover, and 1,715 pounds of hay for the period.

Lot 1 gained 113 pounds.

Lot 2 gained 98 pounds.

CHANGE OF FOOD. — LOT 2 ON FOOD OF LOT 1, AND LOT 1 ON FOOD OF LOT 2.

Lot 1 weighed April 5, or at end of second 49 days, 2,588 pounds; gain, 125 pounds.

Lot 2 weighed April 5, or at end of second 49 days, 2,892 pounds; gain, 198 pounds.

Lot 1 consumed 147 pounds cob meal, 1,552 pounds stover, and 1,577 pounds clover and English hay.

Lot 2 ate 60 pounds of mangels daily, and 1,592 pounds stover, 147 pounds cob meal, and 1,705 pounds clover and English hay.

Excess of gain of mangel-fed steer for 98 days, 78 pounds at 4½ cents, $3.51; excess of food consumed by non-mangel-fed steers amounts to 236 pounds stover and 115 pounds of hay

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for 98 days. The value of this fodder added to value of increase of live weight, and divided by the number of bushels fed, gives a value received for mangels of 5 1-5 cents per bushel of 60 pounds. This would give a value of $1.73 per ton. These figures are certainly not calculated to cheer one on in the hot sun of hay-time, as with aching back he bends again to weeding and thinning this watery food; nor do they afford much inspiration for him when he lags and aches in pulling and carting. Nor more encouraging is the reflection that it is 45 tons of water for 5 of food that he lugs basket by basket from his cellar, chops, rebaskets, and distributes at a painfully slow rate, for the results achieved. These root-crops, mangels and turnips, are not and will not become profitable staple crops for animals in this country. Upon this question of root growing and feeding we have but little in common with England. Even there the results of feeding experiments give to them no better results than I have noted. The extent of this paper will not admit of a review of foreign experiments in root-feeding, but they are not encouraging to a people that cannot feed the roots on the spot of their growth, owing to climatic influences. Chemistry does not attach a higher feeding value to the roots fed during the past three years than the result I have attained, and in fact the recent discovery that nearly one-half of the nitrogen of root-crops heretofore considered albuminoids is really in what is now presumed to be non-flesh-forming compounds, assigns to them now a value hardly as high as obtained in my results, certainly no higher. While it might be pleasant to review the chemistry of roots with reference to their feeding value, would space permit, it would yet bring from the practical farmer, for whom the work is intended, the truthful remark that chemistry can't fix the feeding value of a food, as yet, and also the more doubtful answer that roots are a green crop whose feeding value is measured not alone by the nutritive elements it contains, but also by a certain medicinal effect that acts as a tonic when fed with dry food, aiding the digestive organs by maintaining a healthy normal action. While a long discussion might be maintained on the point, a sufficient answer will be to point to the facts. Feeding experiments are the only true test of the feeding value of a food. To

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those I appeal, and assert that for three years the stock on dry fodder have been cheaper kept and have maintained a constant cheaper and better growth; also, that German experiments, as I gather from an article of Prof. Atwater, reviewing German work, have shown thus far that the combination of much water with the food given is not advantageous. My purpose in these experiments is simply to give to farmers plain, honest figures of plain, honest experiments, that facts may take the place of fancy or doubt, rather than to play the attorney with the figures.

CHAP. XV. — EARLY OR LATE CUT HAY.

In a former report occurred the results of an experiment in cutting and feeding hay harvested at different periods.

Those results indicated that not only was the amount of hay gathered from a given area much larger when cut after bloom than when cut in bloom, but also that the late-cut hay was more nutritious, as shown by the result when fed to steers. The feeding experiment was brief and of course not conclusive, as indeed single experiments seldom can be. Experiments have been renewed for the season of 1879–80, and on a very much broader scale, the results of which I hereby transmit to you. The subject is of so much importance and the results of such character that I shall give the details quite fully, that all may have opportunity to judge from the data taken whether the results probably fairly represent what will be likely to occur in ordinary practice.

Three acres of ground, seeded all at the same time, were divided into six narrow (two rods) and long plats (forty rods). Each plat contained just one-half acre. These plats were staked out and lined carefully, being mown exactly under the line. Two plats (not side by side) on one acre were mown June 30, when the grass (herd's-grass mostly, with a little clover) was headed, not in bloom, or yet commencing to bloom. The clover was in bloom. Two alternated plats were cut July 9, two days after full bloom, being deferred in cutting, by rain, a couple of days. The two remaining plats were cut July 19, when the seeds were forming but not yet ripe. In the order in which they were cut I will name the cuttings early cut, cut in bloom, and late cut. The product per acre stands as follows: —

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Early cut, weight when dried, 3,035 pounds; weighed when fed out in winter, 2,351 pounds.

Cut in bloom, weight when dried, 3,585 pounds; weighed when fed out in winter, 2,673 pounds.

Late cut, weight when dried, 4,555 pounds; weighed when fed out in winter, 3,386 pounds.

It was intended to dry these lots equally, but owing to the character of the weather and difficulty to ascertain precisely when that point had been attained, it will be seen the shrinkage was dissimilar in the barn. It would be when similarly dried. I find all crops shrink more than in 1878.

Shrinkage, early cut, 22.5 per cent.

Shrinkage, cut in bloom, 25.4 per cent.

Shrinkage, late cut, 25.6 per cent.

This large shrinkage will astonish many, but it may be observed that it is much larger than found in 1879, being then 17 per cent for late cut and 19.6 for hay cut in bloom. This hay of 1880 was weighed out daily as fed, and though nicely done it would probably weigh slightly less than it would if weighed in bulk.

PLATS B.

From another section of the farm two acres were divided into plats as the above three acres were, only making, however, four plats of one-half an acre each. The land is flat and was seeded at the same time as the above three acres, this being the second year to grass. It was cut in two alternate plats July 9 and 19, or same dates as the last four plats of the three-acre piece, and weighed dry.

Cut in bloom, 3,470 pounds; weight when fed in winter, 2,324 pounds.

Late cut, 4,530 pounds; weight when fed in winter, 2,928 pounds.

Two acres to clover (with some herd's-grass) were divided into four plats, long and narrow as the previous were, and cut June 30 and July 9, and weighed.

Cut July 1, 4,875 pounds; when fed, 3,600 pounds.

Cut July 9, 4,825 pounds; when fed, 3,707 pounds.

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Shrinkage, first cut, 25.9 per cent; second cut, 23.3 per cent.

YIELD IN 1879.

Cut when one-fourth part in bloom and weight at feeding, 2,760 pounds.

Late cut, or same as late cut above, weight at feeding, 3,538 pounds.

SECOND CROP.

The difference in weight of hay cut at different periods, even for the short periods above named, is very large indeed. The question arises, does not the second crop cover a large part of that difference? Most do not cut a second crop. The college farm does, and it appears that there is not much difference seen in the second crop of either cutting. None was observed in 1878, but in 1879 there was, on account of the intense drouth after cutting, a small difference. The first cutting had made some growth before the drouth had affected it much, yet the whole growth was not enough to make the difference of the first cuttings.

FEEDING VALUES.

Animals fed, cows. Six cows were divided into lots of two each. Previous food, corn-fodder, clover, and cob meal. On this food for each lot the following yields were noted per day for eight days: Lot 1, 41 pounds; lot 2, 45⅛ pounds; lot 3, 45¼ pounds. Lot 1 was then fed earliest-cut hay; lot 2, second cut; and lot 3, latest cut; each lot having in addition 2½ pounds per cow per day of cob meal. Yield of lot 1 for last twelve days of following fourteen days, 40⅓ pounds milk per day. Pounds of milk required to make a pound of butter, 26.9. Hay consumed for fourteen days, 825 pounds.

At expiration of this period lot 1 was fed on latest-cut hay for the following fourteen days and consumed 705 pounds of hay and gave for last twelve days of the period 38 pounds of milk per day and required 23.7 pounds of milk to make one pound of butter. Less milk was given per day with the latest-cut hay, but less, contrary to general opinion, of milk was required to

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make a pound of butter. Yet while more milk per day is given, it is seen that it requires more hay of the first cut (1.46 pounds to make a pound of milk) than of the late cut (1.38 pounds to make a pound of milk). In regard to the above section of these feeding experiments I wish to quote the words that accompanied my feeding experiment with hay cut at two periods and fed in winter of 1878–79: "I do not consider it safe or wise to draw very broad conclusions from these experiments." Notwithstanding these accompanying words, Prof. Johnson, in his official report of the Connecticut Experimental Station for 1879, proceeds to criticise in a friendly spirit my report of feeding experiments with early and late cut hay, upon the assumption that they were offered as authority rather than as a first brief step, a short link in the long chain of evidence required to establish a fact in this matter. The objections made by Prof. Johnson in part were: that "the contents of the alimentary canal require five and sometimes seven days to pass from the mouth to the stable floor;" therefore no account should be taken of results for first week. Also, that "they require time to get accustomed to change of food, so that results of second week on a changed ration are often unlike those obtained later when the animals get habituated to the diet."

The weight of these objections must be admitted, and were in the caution in my article referred to. Yet I must, while admitting that they are not strictly scientific (this hay given to cows was surplus not needed in steer-feeding, and such facts were taken as they would give as a preliminary inquiry), insist that they may have value as a part of a mass of evidence required. First, I have repeatedly in experiments noticed a very marked change of product after a change of food, within two days. In fact, the product then appears by careful figures to be more determined by the new than the old food. Again, in the experiment criticised, two sets of steers were taken from like foods, and one fed on late and the other set on earlier cut hay. At the expiration of a fortnight one set went from early to late hay, while the other went from late to early hay. While those steers that were put from early to late hay might be expected to get less fill of stomach to weigh, from lessened consumption,

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and, if the late hay was less valuable, would be expected to grow less per pound of food eaten, yet this fact, if a fact, would be checked and measured by those that went from late to early cut hay, for those steers on the early hay would be expected to eat and fill more, and to grow more per pound of food eaten. For the four weeks there was nothing found in the results to warrant the belief that hay cut in bloom was more, or even as, nutritious as that cut later. The brief result from the pair of cows may be taken, as it corroborates the result with the steers last year, as evidence when accompanied by like results of other and more protracted experiments. Also in lot 1, the results of last seven days were like the five days succeeding the first two in each period of the two weeks fed.

LOTS 2 AND 3.

Lot 2, weight Feb. 24, 2,195 pounds.

Lot 3, weight Feb. 24, 1,790 pounds.

Milk per day from Feb. 24 to March 30, or 35 days, lot 2, 36.5 pounds.

Milk per day from Feb. 24 to March 30, or 35 days, lot 3, 35.4 pounds.

Milk required to make a pound of butter, 25.4 pounds, lot 2.

Milk required to make a pound of butter, 25.2 pounds, lot 3.

Weight March 30, of lot 2, 2,165 pounds.

Weight March 30, of lot 3, 1,802 pounds.

Ate, lot 2, 1,748 pounds.

Ate, lot 3, 1,608 pounds.

For 21 days following March 30, both lots were fed alike:—

Lot 2 gave of milk per day for last 17 days, 41 13-17 pounds.

Lot 3 gave of milk per day for last 17 days, 38 5-17 pounds.

Lot 2 required 29.4 pounds of milk to make one of butter.

Lot 3 required 29.8 pounds of milk to make one of butter.

Weight lot 2, 2,145 pounds.

Weight lot 3, 1,805 pounds.

Like lot 1, I find, on careful review of the daily figures taken, that the yield of the last few days of each period corresponds with the whole period given; so that we may assume that the

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cows had become accustomed to the feed, and that the product was fully controlled by it.

These figures again appear to be slightly in favor of the later-cut hay, both in milk-flow and butter-product and maintenance of weight of cow. While lot 3 lost two per cent more in milk-flow in passing from same food with lot 2 to late-cut hay than lot 2 did in passing to hay cut in bloom, yet lot 2 in passing back to same food as before gained five per cent more than lot 3, which should not have been if the hay of lot 2 was the better. The quality of the milk for butter also suffered slightly more than did that of lot 2, showing that the cows were changed from a better butter-producing food. Again, while the loss of lot 2 in weight still continued after change of food, yet not so fast by a small per cent, while the gain observed in lot 3 on late-cut hay nearly ceased. In results unpublished, because not thought worthy, of like experiments, winter of 1878–79, like results were noted as above. It will be observed that the difference is slight between results from 2 and 3. It must be remembered that the hay of lot 2 was cut, not slightly before bloom as last year, but slightly after full bloom but yet before out of bloom. The results, however, point in one direction. The greater part of the hay cut on the plats named above was fed to steers.

Before closing, I would call attention to the comparative value of corn-fodder and clover hay beside good hay, as incidentally brought out by these figures. About double the cob meal was given with the clover hay and corn-fodder that was given with good hay alone. I do not think that it was sufficient to account for the difference of yield.

CHAP. XVI. — FURTHER EXPERIMENTS WITH HAY.

In my last chapter, I gave a partial review of experimental work with early and later cut hay. With this report I shall continue and close the report of work with hay cut at different periods for 1879. Three lots of steers of the same age (two years old), and containing two in each lot, were selected. Weighed Feb. 24.

Lot 1, weight 1,443 pounds, fed hay cut before bloom.

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Lot 2, weight 1,452 pounds, fed hay cut in bloom.

Lot 3, weight 1,450 pounds, fed hay cut out of bloom.

The hay given was from same plats as named in previous report. The above lots of steers were all fed alike on clover hay and corn-fodder for fifty-seven days previous to Feb. 24, for a trial or fitting period to test their relative growing capacity. Lot 1 gained 153 pounds; lot 2 gained 167 pounds; lot 3 gained 162 pounds. For the length of period and amount of gain the growth is quite uniform, and we have a good basis to start upon. Weighed March 30, or at the end of 35 days: —

Lot 1, weight 1,513 pounds; consumed 1,344 pounds, gain 70 pounds.

Lot 2, weight 1,481 pounds; consumed 1,359 pounds, gain 29 pounds.

Lot 3, weight 1,527 pounds; consumed 1,338 pounds, gain 77 pounds.

On a less consumption of food, then, lot 3 on latest-cut hay makes the largest gain. From this period the lots were changed, or the foods were reversed: —

Lot 1, food latest-cut hay.

Lot 2, food latest-cut hay.

Lot 3, food hay cut in bloom.

Weight, May 10, lot 2, 1,500 pounds; ate for 35 days, 1,285 pounds.

Weight, May 10, lot 3, 1,580 pounds; ate for 35 days, 1,454 pounds.

Lot 1, the weight is not given, because the steers were taken with the scours, from some unknown cause, so that before they recovered their weight was obviously affected by it; yet for the first fortnight after change from early to late cut hay they gained faster, as they were yet well, than previously on earlier-cut hay. Apparently the lot on hay cut in bloom have gained, or rather shown the bloom hay to be better than the late-cut hay; but such is not the fact. The result is in perfect accord with the result in the winter of 1878, when the steers were taken from like foods, and, without previous appetites for early hay to overcome, they consumed like quantities, and with like quantities consumed it is seen in both cases that a very decided superior nutritive

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value is found in late-cut hay. Again, it is seen, in both experiments of 1879 and 1880, that when I change from early to late hay those on late hay will not eat as much. Therefore the true test of the relative nutritive values of early and late cut hay will be found in the first period of the experiment when like quantities of food are consumed, or from Feb. 24 to Nov. 3. I wished, however, to note the effects of a change of food, and to check any special case of error. To the feeder who will observe that it is desirable to have large quantities consumed and therefore advocates early-cut hay, it may be observed again, that when starting on hay for the first time in the barn they do consume as much of hay cut at one period as at another and earlier date.

Again, lot 3 on hay cut in bloom requires 1,454 pounds to make 51 pounds gain, while lot 3 in the previous thirty-five days required only 1,338 pounds to make 77 pounds gain. It is true that lot 2 gained only 19 pounds on late-cut hay, while they gained 29 pounds on hay cut in bloom; yet it required 74 pounds more of hay to make this 10 pounds of extra gain, which as extra food over maintenance-fodder is an extraordinary amount, and shows that the hay is not as nutritious as the hay cut out of bloom.

Again, upon the German standards of maintenance-fodder, which for the sake of brevity I will not review, the extra food over and above maintenance eaten by the two lots should have given more gain to lot 3 on bloom hay, if it was as nutritious as the later-cut hay. Finally, the late-cut hay consumed for seventy days was 2,623 pounds, and the gain for the same period was 96 pounds. The hay cut in bloom, eaten for seventy days, weighed 2,813 pounds, and the gain was but 80 pounds. I may add that frequent weights were taken of these lots of steers, and the weights in their indications agreed with the final results before and after the change of food, excepting in one instance in the change from hay cut in bloom to late-cut hay. This lot lost weight the first week, and after that period gained faster on late-cut hay than did those on hay cut in bloom.

CLOVER HAY.

Lot 1, of six three-years-old steers, weighed 5,778 pounds April 5.

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Lot 2, of six three-years-old steers, weighed 5,770 pounds.

For ninety-eight days previous to the experiment both lots were fed alike.

Lot 1 gained 400 pounds; lot 2 gained 243 pounds.

Lot 1 was fed clover cut in bloom and oat-straw (clover cut July 1).

Lot 2 was fed clover after bloom and oat-straw (clover cut July 9).

Weight lot 1, April 26, or at the end of 21 days, 5,819 pounds. Ate clover, 1,970 pounds; straw, 885 pounds.

Weight lot 2, April 26, or at the end of 21 days, 5,842 pounds. Ate clover, 1,895 pounds; straw, 902 pounds.

From April 26 both lots were fed clover to May 8.

Weight lot 1, May 8, 5,802 pounds. Ate 1,630 pounds.

Weight lot 2, May 8, 5,868 pounds. Ate 1,482 pounds.

Here there are four lots of six steers of like weights and ages, and lot 1 gaining on the same food for ninety-eight days, fitting period, very much more than lot 2. We find that on less of later-cut clover they now make more gain, and on clover, too, a food that is pre-eminently supposed to lose value by the shedding of its leaves by late cutting.

This is the end of the sixth trial, and all point in one direction. Is it all an accident, this uniformity of result? I am convinced, against my previous judgment, that the doctrines in vogue in favor of early cutting hay have been carried to a great excess, and that it is probably true that hay had better be cut at some period not determined, after bloom. While not asserting that the fact is proven that it is more nutritious then, I consider it more than probable that it is; and when the amount of nutrition per acre is considered, certain. In the meanwhile I propose to continue these investigations.

THEORETICAL CONSIDERATIONS.

Recent discoveries in the chemistry of plant-analysis have somewhat modified the theoretical values that chemists would attach to grass cut at different periods of growth, in favor of later-cut hay, or hay approaching maturity. In the earlier stages of growth a large part of the nitrogen heretofore reckoned as

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albuminoids has been found to be non-albuminoid compounds and generally assumed to be non-flesh-forming. In eighteen samples of hay analyzed at the Connecticut Experimental Station, this non-albuminous nitrogen varied from 8.93 per cent to 24.36 per cent of the total nitrogen. Prof. Collier's analyses have shown a large per cent of these nitrogen compounds, while foreign results, when these facts were first brought out, are quite full in this direction. Notwithstanding this important qualification of previous theoretical values given to hay cut at varying dates, chemistry as yet asserts the superior value of early-cut hay over late, pound against pound. Prof. S. W. Johnson, who is everywhere recognized as authority in agricultural chemistry, in the report of Connecticut Experimental Station for 1879, says on page 85 in answer to an inquiry: "I agree with you also that an acre of grass cut about heading time is worth more than cut at any subsequent period."

So far as that experiment may be taken as evidence in the case on the scientific side, I refer the inquiring and curious reader to the very full analyses by Prof. Collier of the three samples of hay fed, which can be obtained by addressing Secretary James O. Adams, Concord.*

In the meanwhile, while the question is at issue, it may be said that chemistry never has succeeded in fixing the nutritive value of complex foods, and itself must be led and directed to more thorough research by facts. Agricultural chemistry must not, however, be lightly thought of.

In the interest of accurate facts, I must not omit to state that the hay cut in bloom was cut in the afternoon, and while yet thoroughly green was wet by a quick, light, and fleeting shower that left no traces on the hay, as it remained bright, and was relished, as seen by the figures, better than the late-cut hay. Its effect on its value might be somewhat problematical, but fortunately the same shower wet the latest-cut clover that is seen to be so much more favorable than the earlier-cut and unwet clover.

* For Prof. Collier's report, see paper on Chemical Analyses, in this volume.

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HIGH-LAND AGRICULTURE.

BY J. L. GERRISH, OF WEBSTER.

For a few years past, much has been said and written calculated to stimulate New Hampshire farmers to raise more corn.

Those who occupy a certain class of soils, may well heed the advice, and profit by it. Except in years of extreme drouth, or early autumn frosts, there are two kinds of land, common in this State, that can be profitably planted to corn; especially, if they are in large areas, and of such shape as to be readily operated by improved implements. They are the better class of plain lands, and such alluvial soils as are above high-water mark, and consequently too dry to be classed as grass-lands. Farmers cultivating such lands have been pretty well instructed by members of the Board of Agriculture and others: while those of us who still choose to remain farming the rocky hillsides and swells, have mostly been plodding along in the old way, — breaking up yearly a few acres that need reseeding; plowing or harrowing in nearly the whole stock of manure; hoeing a year or two to corn or potatoes, or both; and then stocking down to grass with a crop of wheat, or after a crop of oats.

In the first place, there are so many broken furrows, on account of the stony nature of the soil, that it is not practicable to turn over the sod and seed to grass immediately, as on soils that are free from stones.

In the second place, corn must be had for feed on the farm. It must be raised in the manner described, and practiced by

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our fathers; or it must be bought with the cash received from the sale of our marketable products. Those who go regularly to market, and sell butter or milk for cash, claim that they can buy, feed, sell the product, and reconvert to corn again, while a crop of hoed corn might be maturing in the field. Persons thus situated can possibly afford to buy, but they are the exception, not the rule, throughout the State.

In the third place, the possibility of a still better course than either of the above presents itself to the mind of the progressive farmer of to-day; that is, whether we cannot ascertain by experiment which of the three leading elements of fertility found to be needed in a corn-crop is most profitable for us to buy, to produce such a crop. Or, if more than one is required, in what proportions can they be used? Cannot we raise corn with chemicals, or superphosphates, profitably, and apply our nitrogenous, animal manures to forage crops, such as green oats, rye, millet, and fodder-corn; or else use them directly for grass and clover?

When we have applied the larger part of our year's stock of manure to the corn-crop, perhaps plowing much of it under the sod in a raw or unfermented state, have we not lost the interest on it in a measure? Has it not made the stover too coarse and rank to be fed profitably, and spread out the cob at the base, increased the proportion of cob too much, and made the corn later in ripening than is desirable?

Cannot we manure a few acres near the barn better than heretofore, and, by double cropping or otherwise, get a larger return for the same amount of labor, by drawing such bulky and heavy manures short distances, treating fields that are farther off to chemicals for hoed crops, or ashes, plaster, and ground bone as a top-dressing for grass, or turn them out to pasture altogether?

If we are raising young cattle or horses for their growth, these and similar questions may well occupy our minds if we wish to keep abreast of the times and make our business profitable.

To those whose farms are carrying sheep more than other stock, such questions may not seem of so much importance, as

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they can remain in distant pastures until late in autumn, and do not require such treatment at that season as cows, which, of course, should receive such feed as will keep up the flow of milk, and that without turning them into the fields to graze at *any time.*

Having lived up to the latter pretty well for a few years, we have been obliged to adopt a partial soiling system for the fall months, which has in turn increased our stock of manure, as the cattle are tied up at night and kept longer in the barn.

It has been proved by several years' experimenting, that, by taking a little pains in managing the manure and teams, much can be done (on warm soils) towards raising these fodder-crops, by a system of double cropping. That is, by mowing June-grass or witch-grass early, say the 25th of June, and by having the manure saved and teams at hand immediately put in the plow and sow fodder-corn or millet for a second crop.

Six years ago the present season, I closed an article published in one of the leading agricultural papers in the State, with the following inquiries: What is the best course to adopt for those who choose to remain on the rocky farms? Can we in a year's time break up, raise a crop of winter rye for forage, also a crop of Hungarian grass harrowed in on the rye-stubble, and then turn over with a seed-plow, and find a rotten sod fit to make a good seed-bed for grass in the fall or early spring following?

No doubt this can be done successfully now that we can use the wheel-harrow to put in the millet on the rye-stubble. I tried the experiment about the time the article was written, but failed to make the Bucklin harrow work well on the rye-stubble; consequently the idea was given up for the time.

Having read an article (in the report of the Board of Agriculture for 1877) by Mr. Cheever of Sheldonville, Mass., I started with two acres of rye last fall, by plowing in wheat and oat stubble and sowing two bushels to the acre, which came up finely, as did also nearly as many oats which scattered at harvesting. It is expected that the frost-bitten oats and a liberal dressing of fine manure, which was applied as soon as the ground was frozen, will give a good winter protection and make

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a good crop of forage in June, to come off in season for a full crop of millet, for which the manure applied to the rye will be in available condition.

We have a piece of warm land near the buildings that has produced two crops of grass, a crop of millet, and one of fodder-corn, in the last two years. The corn, sown as late as the last of June and the first week in July, grew to a height of six or seven feet, and weighed three and one-half to four tons per acre, after lying in the swath eleven days of beautiful weather.

The principal difficulty in double cropping seems to be the usual scarcity of manure, as it is customary to use everything up and scrape the yard at planting.

This trouble may be got over well enough if we satisfy ourselves as to what our corn-crop needs, and buy, and apply in the hill at planting if it is phosphoric acid, and on the hill at time of hoeing in the shape of ashes if potash is wanted. Experiments conducted on our farm the past season go to show that phosphoric acid can be bought to grow corn with, as can Bradley's XL superphosphate, also E. F. Coe's and Bowker's hill and drill fertilizer, although the two latter had too much nitrogen for that particular season, and were not as profitable as the XL, which, applied at a cost of about eleven dollars per acre, nearly doubled the crop. Repeated huskings and weighings showed the natural product of the soil (which was bound out and had not been plowed for nearly ten years) to be one-half pound of ears of corn to the hill; with two ounces of superphosphate in the hill and no other manure, about a pound of ears. An acre of four thousand hills would produce, in round numbers, two thousand pounds of ears with no manure; the same, with eight thousand ounces (five hundred pounds) of Bradley's XL superphosphate in the hill, would produce four thousand pounds of ears.

Having experimented with about twenty plats of corn the past summer, and these plats being quite uniform as to soil and former treatment, as well as care received during the growth of the crop, it may be profitable to present the result, that it may be compared with similar experiments in different parts of the State, and on a variety of soils.

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The piece chosen for experiment was hill land which had been mowed eight years in succession; it had been plowed and planted with corn ten years before, dressed with barn-yard manure, and also top-dressed with unleached ashes, perhaps five years ago, which fact may account for the very poor return for potash in the present experiment. The soil was lightish loam, with hard-pan underneath, found at a depth of from two to four feet.

Eleven plats were selected on which to conduct an experiment intended to show whether the soil was deficient in amount of available nitrogen, potash, or phosphoric acid, or in more than one. Also, to learn if potash and phosphoric acid were lacking, whether nitrogen could be applied profitably in mineral form, and to what extent; whether in full, one-half, or one-fourth the amount supposed to be required in a complete manure.

We consented to try the latter, in order to make the same trial that others were making in different parts of the State. Being prejudiced as to its profitable use on our farm, by some experiments conducted in 1878, we did so with some hesitation on account of its being the most expensive fertilizer in the market.

The chemicals used were kindly furnished at cost by Mr. Sanborn, superintendent at the college farm; and for the sake of getting a very uniform piece of land, we were obliged to put the amount intended for two-by-four-rod plats on strips six by one rods. Two-thirds of the fertilizer was applied broadcast and harrowed in, and the remainder in the drill. Nitrogen was supplied from sulphate of ammonia, potash from muriate of potash, and the phosphoric acid in dissolved bone-black. The several kinds used on any plat, where more than one was applied, were carefully mingled and pulverized. The plats contained 4 rows of 29 hills each, or 116 hills, being 1-33 of an acre of 3,828 hills. The stalks were cut and the corn husked in the field late in the autumn, so no account was made of the stover.

We will, for the sake of comparison, commence with plat 3, on which nothing was applied. This produced 55 pounds of ears

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of corn, showing the natural capacity of the soil to be 55-116 of a pound of ears to a hill, or nearly one-half pound.

Plat 1, phosphoric acid costing 20 cents applied. Yield, 90 pounds of ears, or 35 pounds more than the nothing plat near it; 35 pounds of ears for 20 cents' worth of bone-black.

Plat 2, potash, costing 41 cents, producing 81 pounds of ears, or 26 pounds more than the nothing plat; 26 pounds of ears for 41 cents.

Plat 4, nitrogen, costing $1.01, which produced 39 pounds of ears, or 16 pounds less than the nothing plat. The nitrogen was an element not needed in large amounts, and was so strong that it killed and stunted the corn.

Plat 5, nitrogen, potash, and phosphoric acid, costing $1.62; product, 116 pounds of ears. (It appears that this plat produced just 1 pound of ears to the hill, about the same amount that was produced by Bradley's XL superphosphate in a plat near by. The cost of this complete fertilizer, as applied, was over four and one-half times as much as the superphosphate, which produced a like result on an adjoining plat, although much might be owing to the different methods of applying them, as the superphosphate was all put in the hill, while the three leading mineral elements were put two-thirds broadcast and the remainder in the hill.)

Plat 6, phosphoric acid and nitrogen, costing $1.21, produced 60 pounds of ears. The nitrogen was too strong for the roots.

Plat 7, same as plat 5, except that only one-half the amount of nitrogen was used, which reduced the cost to $1.11½; product, 110 pounds of ears.

Plat 8, phosphoric acid and potash; cost, 61 cents; product, 92 pounds of ears.

Plat 9, potash and nitrogen; cost, $1.42; product, 54 pounds of ears.

Plat 10, same as plat 5, except one-fourth the amount of nitrogen, reducing the cost to 86¼ cents; product, 128 pounds of ears.

Plat 11, same as plat 10, except three-fourths instead of one-fourth nitrogen, costing $1.36; product, 134 pounds of ears.

Perhaps this method of presenting the result of the experi-

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ment may be more acceptable to the general reader than if put in the form of a table. Let us recapitulate in order to compare results. The great need of this soil seems to have been phosphoric acid, as appears in all experiments conducted on hill land, that have come to my knowledge. In this case, applied at the moderate cost of $6.60 an acre, it almost doubled the product of pounds of ears of corn, and, no doubt, quite doubled the value of the crop, had the fodder been weighed.

Let us compare with plat 8, on which potash was used in connection with the same amount of phosphoric acid as in plat 1, at an additional cost of 41 cents. We find an increased product of only 2 pounds, which is, no doubt, in part due to a dressing of unleached ashes applied about five years since. It is probable that had one-half the amount of phosphoric acid been applied by sprinkling over the space of a square foot to each hill, and worked into the soil with a hoe, it would have given quite as good results the present year, although not making a great saving in cost, only as a part of the expense would be in the labor of the farmer or some of his neighbors, instead of in cash sent out of the State for bone-black.

The plat on which the full amount of nitrogen with the other two elements was used, cost $1.62, and returned only 61 pounds above the natural product of the soil, while where one-fourth the amount of nitrogen was used, reducing the cost to 86¼ cents, was produced as much corn lacking 6 pounds of ears!

In seasons of drouth, no doubt these figures might take different shape, and it is expected that no one will invest largely in any one element of fertility to use on his farm simply because it has been a success on some other farm in a single year; but the results of these experiments will encourage the writer to manufacture a fertilizer the coming season, having for its base dissolved bone-black with a small amount of potash and nitrogen in some form, and use, or cause it to be tried on a number of hill farms in this vicinity.

In regard to experiments with superphosphates, I would say briefly that Bradley's XL, E. F. Coe's, and Bowker's hill and drill fertilizers were each used, both broadcast and in the hill.

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Bowker's used broadcast gave best results, but was not profitable for the first crop used in that way, but each of the three kinds were quite so when used in the hill at the rate of about two ounces to each hill, Bradley's XL giving the best results, nearly doubling the crop of ears of corn by weight, and stover also apparently as estimated.

The crop was increased about one-fourth by the use of about a teaspoonful of plaster in the hill ; cost not estimated.

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THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

BY S. D. LORD, OF MANCHESTER.

We have endured what we would not again. We would not restore the system of *pounds*, *shillings*, and *pence*. Many of the readers of this paper remember the *ninepences* and *fourpences* "of our fathers," thrown away by a single stroke of the legislative pen. The same fate has followed the *trade* dollar. If you will take down from your shelves the arithmetics of your school-days, Adams's, Welch's, Colburn's, Greenleaf's, you will see how many weary pages of figures are of use no longer; so many pages of arithmetical literature gone forever, supplanted by two words, — *dollars* and *cents*. The old school committee, as he was called upon to propose questions to the class in arithmetic, was sure to ask, "What is a shilling?" "What is the difference in a New Hampshire and a New York shilling?" Look at the ledgers of your grandfathers, and you will find the "£, s., and d.," — now worth learning only because they are retained in England. I have no doubt many *old mothers* objected "to the new notions some folks are always getting up," and did not see how they were going to buy tea with *cents* when it was always sold in *shillings* and *pence*.

If, when dollars and cents were adopted, a decimal system of *weights* and *measures* had been also introduced, what a blessing would have been added to the other innovation! But this is a world of evolution, and it takes time for development.

England, in 1864, made the "Metric System" permissive,

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and the United States did the same in 1866, and New Hampshire has also gone so far as to give *permission* to use that system by the adoption of the United States law. But scientific men alone use it, and that for scientific purposes, except the apothecaries in some places. To make it effective, an act should be passed fixing the time of its adoption Jan. 1, 1890, and prohibiting the use of any other system, with a penalty *that no debts should be recovered by process of law when the goods sold were not measured or weighed by the metric system.* There would be one day only of scolding, to be followed by years of rejoicing.

Our present system is mixed, complex, and doubtful. The word "pound" represents *two* quantities here; and if you use the English system of currency, *three.* There are two different gallons, and as many quarts and pints. In our statutes, chapter 121, sections 5 and 6, the little word "can" is used with two different significations. First, it must contain "one or more quarts;" and second, "if milk is purchased by the *can, such can* shall hold eight quarts and no more." So, if one purchases a can of milk containing "one or more quarts," he must not purchase it by the "can": there is a penalty of fifty dollars. It is only when the can holds eight quarts that he must purchase it by the "can." It is evident that the purpose of the legislature was to make the word "can" a distinct *trade* word, — technical, perhaps. The objection here is in using this tin vessel for double purposes. There can be no more crime, *per se*, in buying and selling milk by the can of one quart than by the can of eight quarts.

In 1860 our milk gallon was 282 cubic inches, but in 1873 it was made 231 cubic inches, — a difference of 51 cubic inches, or 12¾ cubic inches for every quart. Quite a change; and no just reason can be assigned for such change, unless it be to correspond with the *gallon* of a neighboring State. A good reason, perhaps, but if the change were made to correspond with the known measure of the world it would be much better.

If you purchase of a grain-dealer you get one kind of *quart*, of the wine-dealer you get a different kind of quart; of the grocer you will get one kind of measure, and of the apothecary another. The grocer gives you sixteen ounces for a pound, the

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apothecary twelve ounces. If the apothecary should compound for you his medicines by the grocer's scales, he might poison you; 7,000 grains make a pound in one shop and 5,760 make a pound in the next.

Read the "prices-current" in New York and Boston, and many of the articles with which you are familiar are quoted in *terms*, representing *quantity*, that are unknown to you, and it is a blank to you. I name only a few things in this connection; pages might be written of these differences. They will suggest themselves to you here. Would you not better comprehend your schedule of prices-current if the weights were quoted from Paris, London, Chicago, and Boston in a known quantity, — say "kilogram?" Then, if you understood that word, you could easily compare the markets of those places.

The proposition is to substitute the new *decimal metric* system for our old way of weighing and measuring. One will see how much easier and simpler it is to use the decimal system in our currency, than the old pounds, shillings, and pence. The metric system gives the same simplicity to weights and measures, and there is the additional fact that a measure always represents the same quantity. The grocer, the apothecary, the silversmith, can and must use the like weight. But why is it called "the Metric System?" Simply because it is founded upon the *meter*, which represents a known measure of length, 39.37 inches. This is divided into tenths, hundredths, and thousandths, and from the meter and fractions of it weights and measures are formed.

But why not take the foot? What *foot?* Dr. Barnard of Columbia College, in an address in 1871, says: "The Greeks used the foot earliest, and the Olympic foot is said to have been the measure of the foot of Hercules. But there were foot measures in use among them of several other magnitudes; and while it is difficult to know with certainty what any of them were, compared with ours, it is not difficult at all to ascertain that they differed widely among themselves. Thus the authorities state that the Macedonian foot was 14.08 inches, the Olympian 12.14 inches, the Pythian 9.72 inches, and the Sicilian 8.75 inches. Here in the earliest history of this measure we have the largest

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room for choice. In more recent times the diversity has been greater still. Thus, in Italy, the foot was not long ago 11.62 inches in Rome, 13.68 inches in Lombardy, 23.22 inches in Lucca. In France it was 9.76 inches in Avignon, 9.79 inches in Aix-en-Provence, 10.57 inches in Rouen, 14.05 inches in Bordeaux, while the *Pied du roi* for France was 12.79."

And in the Memoirs of the United States Sanitary Commission, prepared by Dr. B. A. Gould in 1869, it appears some sixteen thousand volunteers, eleven thousand being white and five thousand colored, were examined. Dr. Gould says: "The mean length (of the foot) was found for no nationality to exceed 10.24 inches, and for none to fall below 9.89 inches, the value of the total being 10.058."

The old English foot is said to be derived from the yard of three feet, and the yard was the measure of the arm of King Henry I. in 1101; but it is a Saxon measure also. The arm might be convenient for measuring the yard if all arms were of the same length. Sir John Herschel's rule for the yard is said to be: "Hold the end of a string or ribbon between the finger and thumb of one hand at the full length of the arm extended horizontally sideways, and mark the point that can be brought to touch the center of the lips facing in front."

An attempt has been made by learned mathematicians to perpetuate the present *foot*, making it permanent by the arbitrary application of the length of the pendulum as found to be at Greenwich, England. The pendulum vibrating sixty times a minute, or once a second, is found at Greenwich to be in length 39.1393 inches; that is, divide the pendulum in 391,393 parts, and 10,000 of them is an inch, and twelve times that will be a foot. A cubic inch of distilled water at 62° temperature was found to weigh 252.458 grains; or, if we divide the cubic inch of water into 252,458 parts, 1,000 of them will weigh a grain. If, then, by this system, we were to *find* the *inch* and the *grain*, we have some very extensive divisions to make, even after having found the length of the pendulum, according to the latitude and elevation of Greenwich. Let us hope the foot will never be lost again and put us to the test of figures like these.

The units of weights and measures of England, and which are

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ours also, came from the Saxons. They were the Winchester measures. These standards were deposited by the king's orders in buildings specially designed and consecrated to them, and since 1866, according to Chisholm, are kept in a fire-proof room in an "iron, fire-proof chest." King Edgar confirmed the Winchester standard. The *yard* is the oldest, and it is said the imperial yard of England to-day exceeds it only by about a hundredth part of an inch, and Chisholm (warden of the standards) seems to believe that its origin may be traced to the Egyptian and Hebrew cubit, it being equal to a double cubit nearly. The same authority speaks of the "mint pound at the Tower of London" as the only legal standard for monetary weight. It was of the same weight as the German apothecaries' pound, equal to 5,400 of the present grains, the earliest form of the pound sterling. The Tower pound was abolished in 1527, and the Troy pound was substituted, "which maketh xii oz. Troye, which exceedeth the Pounde Towre in weight iii quarters of the oz."

The *avoirdupois* pound of to-day derives its authority from the old French commercial pound of sixteen ounces, and agrees with the pound in use in the time of Edward III. In the time of Elizabeth the avoirdupois pound was equal to 7,000 grains of the Troy-pound grains, which pound was 5,760 grains, the standard weights of Henry VII. having been destroyed.

According to these standards the Winchester corn bushel was 2,150½ cubic inches, and the corn gallon was 274¼ cubic inches. The standard ale gallon was 282 cubic inches in the time of Queen Elizabeth, and in the time of Queen Anne 231 cubic inches was the capacity of the wine gallon.

But in 1824 all these standards of the gallon were abolished by the adoption of the new *imperial standard gallon* of 10 pounds of water, of the capacity of 272¼ cubic inches. Our gallons are those used in England prior to 1824.

These weights and measures have from time to time since 1824 been revised and established by comparison with old standards, and, when the old standards were lost, by comparison with those known to be faithful copies.

In 1855 copies of the British standards of length and weight

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were sent to the United States government through Mr. Airy, astronomer royal, and were compared by Mr. Saxton, under direction of Prof. Bache, with those of the United States. In these trials the British bronze standard yard was found to be shorter than the American by .0008 of an inch, and if allowance is made for the temperature of the standards the difference would be increased to .00087, equal nearly to one-thousandth of an inch.

The great difficulty in determining standards is to find a *constant*, whose measure neither increases nor diminishes in time, — one whose length in 2880 will be the same as in 1880; but none has been suggested where all objections are obviated. Sir John Herschel, after the theory of the French, suggested the polar axis of the earth as equal to 500,482,296 inches of the *imperial* standard, and that if one five-hundred-millionth part of it were adopted as the "geometrical inch," it would differ from the imperial inch less than one-thousandth part of an inch; others suggested the *vibrating pendulum:* but the only sensible idea so far is, that, having established a unit measure, — "Keep it forever."

It is worthy of remark that the English imperial standard *yard* and the American were copied from the same original and perhaps by the same Capt. Kater.

Had England first adopted a decimal system, applying it as the metric system has been, there can be but little doubt it would have been adopted. England is slow; she has no decimal system of money, and has very nearly the system of weights and measures we have.

When the metric system was first advocated, no nation in the world was using it; and though it originated in France in 1791, it was not adopted by the government and made obligatory till Jan. 1, 1840. Its merits of course were recognized, and it is now adopted by every great nation of the earth except England and the United States: yet England in 1864, and the United States in 1866, made it permissive; that is, any person can buy and sell by that measure and weight and the courts will recognize it as a valid transaction.

The history of the formation of this system I give as found in

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the Report of John Quincy Adams, Secretary of State of the United States, in 1821 : —

" In the year 1790, the Prince de Talleyrand, then Bishop of Autun, distributed among the members of the Constitutional Assembly of France, a proposal, founded upon the excessive diversity and confusion of the weights and measures then prevailing all over that country, for the reformation of the system, or, rather, for the foundation of a new one, upon the principle of a single and universal standard. After referring to the two objects which had previously been suggested by Huyghens and Picard, — the pendulum and the proportional part of the circumference of the earth, — he concluded by giving the preference to the former, and presented the project of a decree : First, that exact copies of all the different weights and elementary measures *used* in every town of France, should be obtained and sent to Paris. Secondly, that the National Assembly should write a letter to the British Parliament requesting their concurrence with France in the adoption of a national standard for weights and measures; for which purpose, commissioners, in equal numbers from the French Academy of Sciences and the British Royal Society, chosen by those learned bodies respectively, should meet at the most suitable place and ascertain the length of the pendulum at the forty-fifth degree of latitude, and from it an invariable standard for all measures and weights. Thirdly, that, after the accomplishment, with all due solemnity, of this operation, the French Academy of Sciences should fix with precision the tables of proportion between the new standards and the weights and measures previously used in the various parts of France, and that every town should be supplied with exact copies of the new standards and with tables of comparison between them and those of which they were to supply the place. . . .

" Whether the forms of the British Constitution, the temper of political animosity then subsisting between the two countries, or the convulsions and wars that afterwards ensued, prevented the acceptance and execution of this proposal, it is deeply to be lamented that it was not carried into effect. . . .

" But, in the first instance, a committee of the Academy of Sciences, consisting of five of the ablest members of the Academy and most eminent mathematicians of Europe, — Borda, Lagrange, Laplace, Monge, and Condorcet, — were chosen under the decree of the Assembly, to report to that body upon the selection of the national standard and other principles proper for the accommodation of the object. Their report to the Academy was made on the 19th of March, 1791, and immediately transmitted to the National Assembly, by whose orders it was printed.

" The committee, after examining three projects of a national standard, — the pendulum beating seconds, a quarter of the equator, and a quarter of the meridian, — had, on a full deliberation, and with great accuracy of judgment, preferred the last, and proposed that its ten-millionth part should be taken as the standard unit of linear measure; that, as a second standard of comparison with it, the pendulum vibrating seconds at the forty-fifth degree

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of latitude should be assumed, and that the weight of distilled water at the point of freezing, measured by a cubical vessel in decimal proportion to the linear standard, should determine the standard of weights and vessels of capacity."

Seven years were occupied in the trigonometrical measurement of an arc of the meridian extending from Dunkirk to Barcelona, through France. The object was to determine the exactness of the linear *meter*. It was done with great exactness, but it is said recently not to be exact.

Capt. Clarke computes the meridian passing through Paris to be 10,001,472.5 meters, and that of meridian quadrant in longitude 105° 3″, 10,000,024.5 meters. In the first computation, the difference is 1,472½ meters; in the latter, 24½ meters: and then the French may have been the most accurate. It certainly cannot be expected in computing such a distance, that perfect accuracy is to be attained, when we see in copying the English *old yard* from the same original a discrepancy of nearly one-thousandth of an inch in the computations of the English and the United States.

It may not have been exact at the time; but, if exact, geological changes are constant and may explain all differences.

A *meter*, then, is the supposed ten-millionth part of the distance of a meridian from the equator running through France to the north pole, which meter in our measure is 39.37079 inches, or a little more than 3⅓ feet. This was approved by appropriate legislation in France, but was not adopted there to the exclusion of all other systems by legislative act till July 4, 1837, to take effect Jan. 1, 1840. Thus even France was tardy in its adoption.

The difficulty with us is in eliminating from our minds the *ideas* of *inch*, *foot*, *quart*, and substituting others, for it is nothing really but a change of name; and it is not necessary to be metaphysical, and, when the *meter* is before us, evident to the eye, it will soon become concrete.

We represent the meter by a constant line; in our system it is 39.37 inches long. We may divide this line into tenths, hundredths, and thousandths, and we may multiply it by 10, 100, 1,000, etc.; in the one decreasing by tens, and in the latter increasing by tens. To make it plainer, I put it in another form, the *meter* being the base: —

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10,000 meters equal	393,700 inches.
1,000 meters equal	39,370 inches.
100 meters equal	3,937 inches.
10 meters equal	393.7 inches.
1 meter equals	39.37 inches.
$\frac{1}{10}$ meter equals	3.937 inches.
$\frac{1}{100}$ meter equals	.3937 inch.
$\frac{1}{1000}$ meter equals	.03937 inch.

Instead of using the figures 10,000, 1,000, etc., we place as a prefix the Greek words *myria* for 10,000, *kilo* for 1,000, *hecto* for 100, *deca* for 10, and the Latin words *deci* for .1, *centi* for .01, *milli* for .001, and we have a *word* that expresses our meaning of that number of figures; for example, *myriameter* means *ten thousand meters*, and *millimeter* means the *thousandth part of a meter*.

Now we are prepared to form a table of the *meter*: —

Myriameter,	10,000 meters,	equals	393,700 inches, or 6.2 miles.
Kilometer,	1,000 meters,	equals	39,370 inches, or .62 mile.
Hectometer,	100 meters,	equals	3,937 inches, or 328 feet.
Decameter,	10 meters,	equals	393.7 inches, or 32.8 feet.
Meter		equals	39.37 inches.
Decimeter,	$\frac{1}{10}$ meter,	equals	3.937 inches.
Centimeter,	$\frac{1}{100}$ meter,	equals	.3937 inch.
Millimeter,	$\frac{1}{1000}$ meter,	equals	.03937 inch.

Using the same prefixes before the word *gram*, we have a table of weight; and before *liter*, we have a table of capacity. The simplicity is made manifest. If you know the meter, the others are its multiplication or division. Thus we have constructed a table of *linear* or *long* measure, by simply prefixing to the word meter the Greek and Latin names of numbers represented in those languages. In like manner we could construct superficial measure, founded upon the square of the meter; or solid measure, founded upon the cube of the meter; and the capacity, by constructing a box, the inside of which will be equal to a cubic meter, and dividing the contents into liters for liquid measure, or in so many parts of the weight of grams.

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The following tables are transcripts of the act of Congress, 1866, and may be found on page 708, Revised Statutes of the United States: —

MEASURES OF LENGTH.

Metric Denominations and Values.		Equivalents in Denominations in Use.
Myriameter	10,000 meters	6.2137 miles.
Kilometer	1,000 meters	0.62137 mile, or 3,280 feet and 10 inches.
Hectometer	100 meters	328 feet and 1 inch.
Decameter	10 meters	393.7 inches.
Meter	1 meter	39.37 inches.
Decimeter	$\frac{1}{10}$ of a meter	3.937 inches.
Centimeter	$\frac{1}{100}$ of a meter	0.3937 inch.
Millimeter	$\frac{1}{1000}$ of a meter	0.0394 inch.

MEASURES OF SURFACE.

Metric Denominations and Values.		Equivalents in Denominations in Use.
Hectare	10,000 square meters	2.471 acres.
Are	100 square meters	119.6 square yards.
Centare	1 square meter	1,550 square inches.

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MEASURES OF CAPACITY.

Metric Denominations and Values.			Equivalents in Denominations in Use.	
Names.	No. of Liters.	Cubic Measure.	Dry Measure.	Liquid or Wine Measure.
Kiloliter or stere	1,000	1 cubic meter.....	1.308 cubic yard.....	264.17 gallons.
Hectoliter.....	100	$\frac{1}{10}$ of a cubic meter..	2 bushels and 3.35 pecks	26.417 gallons.
Decaliter.....	10	10 cubic decimeters..	9.08 quarts.....	2.6417 gallons.
Liter	1	1 cubic decimeter...	0.908 quart.....	1.0567 quarts.
Deciliter.....	$\frac{1}{10}$	$\frac{1}{10}$ of a cubic decimeter	6.1022 cubic inches....	0.845 gill.
Centiliter.....	$\frac{1}{100}$	10 cubic centimeters.	0.6102 cubic inch.....	0.338 fluid ounce
Milliliter.....	$\frac{1}{1000}$	1 cubic centimeter...	0.061 cubic inch.....	0.27 fluid dram.

WEIGHTS.

Metric Denominations and Values.			Equivalents in Denominations in Use.
Names.	Number of Grams.	Weight of What Quantity of Water at Maximum Density.	Avoirdupois Weight.
Millier, or tonneau	1,000,000	1 cubic meter.....	2,204.6 pounds.
Quintal.....	100,000	1 hectoliter	220.46 pounds.
Myriagram.....	10,000	10 liters.....	22.046 pounds.
Kilogram, or kilo..	1,000	1 liter..... ...	2.2046 pounds.
Hectogram.....	100	1 deciliter.....	3.5274 ounces.
Decagram	10	10 cubic centimeters.....	0.3527 ounce.
Gram.....	1	1 cubic centimeter.....	15.432 grains.
Decigram.....	$\frac{1}{10}$	$\frac{1}{10}$ of a cubic centimeter.....	1.5432 grains.
Centigram.....	$\frac{1}{100}$	10 cubic millimeters.....	0.1543 grain.
Milligram.....	$\frac{1}{1000}$	1 cubic millimeter.....	0.0154 grain.

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The following scheme is copied from the Smithsonian report of 1865, except the words *meter* and *liter* are changed to correspond with the statute: —

SCHEME OF THE METRIC SYSTEM.

Ratios.	Lengths.	Surfaces.	Volumes.	Weights.
1,000,000	.....	.....	....	Millier, or tonneau.
100,000	.....	.....	....	Quintal.
10,000	Myriameter.	.....	Decastere.	Myriagram.
1,000	Kilometer.	.....	Kiloliter or stere.	Kilogram. (2.2046 pounds avoir.)
100	Hectometer.	Hectare. (2.471 acres.)	Hectoliter.	Hectogram.
10	Decameter.	.....	Decaliter.	Decagram.
1	METER. (39.37 inches.)	ARE.	LITER.	GRAM. (15.4322 grains.)
$\frac{1}{10}$	Decimeter.	....	Decliter.	Decigram.
$\frac{1}{100}$	Centimeter.	Centare.	Centiliter.	Centigram.
$\frac{1}{1000}$	Millimeter.	.....	Milliliter.	Milligram.

UNITS OF THE SYSTEM.

The *meter* measures length. It is very nearly 39.37 inches.

The *are* is a measure of surface, — a square whose sides are 10 meters.

The *liter* is used as a unit of both dry and liquid measure. A cubic *meter* is a kiloliter (1,000 liters). It is equal to about .9 of a quart, dry measure, and 1 1-18 quarts, liquid measure.

The *gram* is the unit of weight, and is a cube of water each side of which is .01 of a meter. A *liter* weighs 1,000 grams, and a cubic meter of water would weigh 1,000,000 grams, or a millier, equal to 2,204.6 pounds.

A *stere* is a cubic meter; measures solids.

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UNITED STATES WEIGHTS.

AVOIRDUPOIS.

Dram	equals	$\frac{1}{256}$ pound.
Ounce, or 16 drams,	equals	$\frac{1}{16}$ pound.
Pound,* or 16 ounces,	equals	1 pound.
Quarter,† or 25 pounds,	equals	25 pounds.
Hundred-weight (cwt.), or 4 quarters,	equals	100 pounds.
Ton, or 20 hundred-weight,	equals	2,000 pounds.

TROY WEIGHT.

Grain ‡	equals	$\frac{1}{5760}$ pound.
Pennyweight, or 24 grains,	equals	$\frac{1}{240}$ pound.
Ounce, or 20 pennyweights,	equals	$\frac{1}{12}$ pound.
Pound, or 12 ounces,	equals	1 pound.

APOTHECARIES' WEIGHT.

Grain §	equals	$\frac{1}{5760}$ pound Troy.
Scruple, or 20 grains,	equals	$\frac{1}{288}$ pound Troy.
Dram, or 3 scruples,	equals	$\frac{1}{96}$ pound Troy.
Ounce, or 8 drams,	equals	$\frac{1}{12}$ pound Troy.
Pound, or 12 ounces,	equals	1 pound Troy.

MEASURES.

LENGTH.

Line	equals	$\frac{1}{360}$ yard.
Inch, or 10 lines,	equals	$\frac{1}{36}$ yard.
Hand, or 4 inches,	equals	$\frac{1}{9}$ yard.
Foot, or 3 hands (12 inches),	equals	$\frac{1}{3}$ yard.
Yard, or 3 feet,	equals	1 yard.
Fathom, or 2 yards,	equals	2 yards.
Rod, or $16\frac{1}{2}$ feet,	equals	$5\frac{1}{2}$ yards.

* One pound equals 7,000 grains and is equal to 27.7015 cubic inches of distilled water.

† In Great Britain and Ireland a quarter equals 28 pounds, a hundred-weight equals 112 pounds, and the ton equals 2,240 pounds.

‡ In 1286, 32 grains of *wheat*, well dried, by law of England were equal to 1 pennyweight. Afterwards 24 grains of wheat were made equal to a pennyweight. The foundation of the English weight was the *dried grain of wheat*.

§ 5,760 grains make a pound Troy.

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Furlong, or 40 rods,	equals 220 yards.
Mile, or 8 furlongs,	equals 1,760 yards.
League, or 3 miles,	equals 5,280 yards.

MEASURES OF SURFACE.

Measures of surface are squares of measures of length.

LAND MEASURES.

Rood of land equals 40 square rods.
Acre equals 4 roods, or 160 square rods.

MEASURES OF VOLUME.

Measures of volume are cubes of measures of length.

MEASURE OF WOOD.

16 cubic feet equal $\frac{1}{8}$ cord.
8 cord feet, or 128 solid feet, equal 1 cord.

DRY MEASURE.

Pint	equals $\frac{1}{64}$ bushel.
Quart, or 2 pints,	equals $\frac{1}{32}$ bushel.
Peck, or 8 quarts,	equals $\frac{1}{4}$ bushel.
Bushel, or 4 pecks,	equals 1 bushel.

NOTE. — In New Hampshire by statute 56 pounds of corn and rye; 50 pounds of corn and rye meal; 60 pounds of wheat, beans, pease, and potatoes; and 32 pounds of oats, make a bushel, but parties may agree to any other way.

LIQUID MEASURE.

Gill	equals $\frac{1}{32}$ gallon.
Pint, or 4 gills,	equals $\frac{1}{8}$ gallon.
Quart, or 2 pints,	equals $\frac{1}{4}$ gallon.
Gallon, or 4 quarts,	equals 1 gallon.
Barrel, or $31\frac{1}{2}$ gallons,	equals $31\frac{1}{2}$ gallons.
Hogshead, or 2 barrels,	equals 63 gallons.

Milk must be bought and sold by wine measure, 231 cubic inches to the gallon.

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THE ENGLISH MEASURE.

Gills, pints, and quarts same as wine measure.

Gallon	equals	1 gallon.
Firkin	equals	9 gallons.
Kilderkin	equals	18 gallons.
Barrel	equals	36 gallons.
Hogshead	equals	54 gallons.
Pipe	equals	108 gallons.
Tun	equals	216 gallons.

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THE ENGLISH AGRICULTURE SYSTEM IN CONTRAST WITH OUR OWN.

BY JOSEPH B. WALKER, OF CONCORD.

"Live not in the country without corn and cattle about thee."
— *Lord Burleigh's Advice to his Son.*

To the New Hampshire farmer, visiting for the first time the land of his earlier ancestors, English agriculture presents many strong contrasts with that which he has known at home. Nor are these contrasts confined to the farming of the two countries. They are elsewhere apparent, notwithstanding the identity of race, religion, and language, as well as the close similarity of the education and laws of these people.

While ours is a new land, whose authentic history is confined to a period of some three hundred years, England is an old one and counts its annals by the thousands, and the evidences of age are everywhere apparent in its glorious cathedrals, and castles, and bridges, and crumbling walls. Here appears a church built in Elizabeth's time; there the remnants of an abbey erected three hundred years before; and there a structure reared by the Normans. That fragment of grim masonry was laid by Saxon hands, and that line of crumbling stones was once a Roman wall extending across the country to defend its inhabitants from the fierce incursions of Scottish tribes.

We find in England a general landscape which comes largely from long occupation, abundant means, esthetic culture, and good farming, giving to the country a finish we miss in almost every part of our own. Magnificent old parks, fertile fields, green

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hedge-rows, with a superior and more enduring architecture, are characteristics as yet very sadly wanting in American scenery, and which time only can develop. While our streams and lakes surpass theirs in magnitude, and our mountains rise to elevations far higher than theirs attain, our fields are less green and the general country presents an unfinished aspect rarely encountered in the agricultural districts of England.

While the great national domain, of which our State forms a part, is a vast one, extending from ocean to ocean, — a distance of three thousand miles, — and from the gulf of Mexico to our northern lakes, — a distance of more than a thousand, — England, whose dominion is as wide as the circuit of the sun, and whose influence upon the human race has been incalculably vast, is a very small country ; about four hundred miles the length of it, while its average width is less than a hundred. One may travel from Edinburgh, in Scotland, to Dover, on the English Channel, between sunrise and sunset. The journey from Liverpool to London is made in five hours. One may breakfast in the latter city and afterwards pass to almost any point within its limits in season for supper. In short, the area of England (32,590,429 acres) is only about five and a half times that of our own little State (5,939,200 acres).

Yet, small as it is, it is densely peopled and supports upon its limited surface a population of about four hundred persons to the square mile. In marked contrast with this, New Hampshire has a population of but thirty-three to the square mile.

In England the farms are larger than in our own State. Four hundred acres is a fair size for a good English farm. Ours average but one hundred and twenty-two. A very large part of an ordinary farm in the old country is subjected to cultivation, while the reverse is true of one at home, about one-fifth only of whose area is capable of tillage.

While with us, the number of land-holders is large and the estates small, in England the number of landlords is small and the estates are very extensive. As evidence of this, permit me to cite a statement in detail, taken largely from a late number of the " Princeton Review."

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NUMBER OF SEVERAL GRADES OF ENGLISH NOBILITY, AND THE NUMBER, ACREAGE, AND VALUE OF THEIR ESTATES.

	No.	Separate landed estates.	Acres.	Estimated rental.
Dukes	28	158	3,991,811	£2,357,655
Marquises	33	121	1,567,227	1,383,671
Earls	194	634	5,862,118	5,007,119
Viscounts	52	120	796,849	644,791
Barons	218	560	3,085,160	3,135,852
	525	1,593	15,303,165	£12,529,068

Based upon this statement a little figuring will show that the —

Average number of acres held by each duke is	142,564
" " " " " marquis is	4,741
" " " " " earl is	30,217
" " " " " viscount is	15,324
" " " " " baron is	14,152

These figures apply to Great Britain and Ireland. Great Britain has an area, exclusive of London, of 72,177,766 acres. Of this, —

One-fourth is held by	1,200	persons,	each	having	an average of	16,200 acres.
" "	6,200	"	"	"		3,150 "
" "	50,770	"	"	"		380 "
" "	261,830	"	"	"		70 "

Great as are these landed estates, and small as is the number of their proprietors, their areas are continually increasing and the number of owners is constantly growing less. Already the landed gentry of Great Britain, numbering only about seven thousand, are the holders of four-fifths of its entire area, or of fifty-two million acres. How long this state of things is to continue or how much farther it is to progress, it would be idle for us to speculate; but the fact that three hundred and twenty thousand individuals, out of a total population of about thirty-two millions, should hold substantially all the land of the kingdom, is an extraordinary one, which may well arrest the attention of every reflecting person. In France, which has a population of thirty-seven millions, one finds about eight million (7,846,000) land-owners.

The agricultural system of England is a complex one, and to

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comprehend fully the genius and working of it one must necessarily recur to its origin. Soon after William of Normandy came across the channel and conquered the country at the battle of Hastings, in 1066, he did what no other invader has since done. He confiscated its entire territory, dispossessing the resident owners and taking it for himself. Having done this, he proceeded to apportion it in parcels to his principal followers, in consideration of such services as would be due him, in peace and war, under the ordinary conditions imposed by the feudal system, which he then introduced. The grants of land made at that time were of great extent and served as the foundation of the aristocracy which was afterwards reared upon them. The families thus aggrandized, as well as the estates then bestowed, have changed much during the eight hundred years which have followed. Original families have disappeared and new ones have been ennobled. In some instances several have been merged in one, and in others a single one has been divided. The system of tenure, however, with some modifications, is much — in spirit at least — as it was when first introduced.

Under it, there have grown up three distinct classes of persons concerned in the agriculture of the country, viz.: —

1. The landlords, or proprietors of the soil.
2. The tenant farmers, who hire the land and carry on farming.
3. The agricultural laborers, who simply perform the manual labor incident to the business.

Let us briefly glance at each of these and see what kind of personages they are and how they live.

THE LANDLORD.

The landlord is very often a man of gentle birth and frequently a nobleman. He has generally been liberally educated, and quite likely is a graduate of Cambridge or Oxford. But he is not personally a man of business any further than to give general directions to his agents who supervise and direct in detail the execution of his plans. Some of the larger landed estates, like those, for instance, of the Dukes of Northumberland, Devonshire, Westminster, or Bedford, require a large number of these, consisting of attorneys, managing agents, clerks, etc., of decided ability and varied accomplishments.

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The landlord resides quite likely for one part of the year at a city residence, and during another part on one or more estates in the country. While the character of his town residence is in harmony with his rank, his country home, which is a palace or a fine mansion, is more particularly his home. You will find this in a park, often of great extent, comprising beautiful gardens, extended lawns, wide fields and pastures, graceful avenues, and grand old trees and woods. The park of the Duke of Marlborough at Woodstock, for instance, has a circuit of some fourteen miles. That of the Lucys, near Stratford-on-Avon, with one of the former proprietors of which Shakspeare, as you may remember, once had a little unpleasantness, is comparatively a small affair and may be easily matched by landed estates in New England.

The landlord's style of living corresponds generally with his wealth and rank. During the country season he keeps open doors, and not only lives sumptuously every day himself, but entertains continually large numbers of invited guests. Everything which can make life enjoyable is freely placed at their disposal, — a luxurious table, a well-selected library, music, and agreeable society. Out-of-doors they are offered rides and walks, and in their seasons the sports of the fields and the streams.

Very frequently the landlord is a member of Parliament, and adds to his other duties those attaching to a membership of this great body. He is also the patron of important local enterprises and is continually called upon to encourage these by his presence and his purse.

His consequence is a good deal in proportion to the number of his acres and his wealth. The former gives social position as nothing else does, for the whole aristocratic system is based, and wisely too, upon land. Eminent talent, high character, personal property, — all give distinction, but are all of uncertain tenure and unsafe as the foundation of such an institution.

The landlord is expected to live in a style corresponding to his income, and in fact to his gross income. This not unfrequently proves an embarrassing exaction, as his estates may be heavily mortgaged and charged with large amounts of interest, or with burdensome annuities, which make his net revenue a

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comparatively small one. His gross income, for instance, may be known to be five thousand pounds, and he be expected to maintain a style of living commensurate therewith. At the same time, an examination of his affairs might show that his lands were mortgaged for fifty thousand pounds, drawing an annual interest of two thousand pounds, while his taxes and other yearly charges amount to five hundred pounds more. In such a case, which is by no means an extreme one, his real income is but one-half of its apparent amount.

It can be readily seen, therefore, that a rich man may be, paradoxical as it may seem, at the same time quite a poor one, inasmuch as the demands upon him exceed greatly his actual resources.

Such an explanation removes the surprise with which I once learned that the proprietor of one of the finest estates in England was a poor man, and the astonishment with which I saw some of the finest trees in his park marked for the ax The maintenance of his grandeur was beyond the net returns of his estate. But such instances I apprehend are exceptions to the general rule, and we should look in vain elsewhere for so wealthy a class of men as the landlords of England.

THE TENANT FARMER.

But, leaving the landlord, let us glance briefly at the tenant farmer who hires and manages one of his many farms. Socially, he occupies a position midway between the landlord and the agricultural laborer; much below the former but much above the latter. We cannot apply to him the designation of gentleman, using that term in its English sense, although some farmers, by our republican standard, might fairly claim it. He is often the son of a farmer and has succeeded his father upon land which he has tilled for a generation. He may perhaps have first acquired experience and the necessary capital as an overseer or bailiff on another estate, and then have ascended from the level of a subordinate to the mastership of a farm.

We shall find him fairly educated for his business but by no means a literary man. He is not a great reader even of agricultural writings, but keeps well posted as to the markets and

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has some knowledge of the drift of general current events. He feels well, is apt to be ruddy of countenance, and to feel that beer is a wholesome beverage and that an occasional glass of spirits does him good.

Compared with those of the ordinary New Hampshire farmer, his operations are generally large, for, as before remarked, the average English farm has a larger area than one with us, much of which comes into an established rotation, and consequently passes at regular intervals under the plow. His business requires an amount of working capital which is governed a good deal by the size of the farm and the character of its products. Mr. Ex-Alderman Mecchi told the speaker some years ago that he had invested in working capital upon his farm, at Tip-Tree Hall, about sixteen pounds, or eighty dollars, per acre, but that this amount ought to be increased to twenty pounds, or one hundred dollars, per acre. This amount, however, is far above, very far above, the average, although the English average is much higher than ours.

One great argument used in England in favor of the British over the American system of farming is, that the ownership of the land being in the landlord, the entire means of the farmer are left free for use in the current operations of his farm.

Although the tenant farmer's home is neither a palace nor a fine mansion, it is good enough. Its architecture is more pleasing than the average farm-house with us. Built, as it is, of stone or brick, it has a look of permanency which structures of wood always lack. Age very likely has settled gracefully upon it, and its foundations may have been laid in the time of the Stuarts, and possibly as far back as that of the Tudors. Its brick floor would not please an American housewife, but suits her English sister, who prefers it to one of wood. Its heavy furniture browned by age, the few cheap prints upon its walls, and the small array of showy knickknacks upon the table and mantel, impress one with a belief that the culture of its occupants is not of the highest. The living is abundant and substantial. The general style of the life within is hearty, and in other respects just what the farmer's family incline to make it. It follows their taste and character.

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As the farmer goes to town on market days he likes to be taken there by a spanking roadster, and if his wife sits beside him, although he may laugh at the loud finery that harmonizes with her florid face and full figure, he still thinks it all right and enjoys it. If he can have consequence in his class he is content, and consoles himself for being compelled to look up deferentially to his landlord by being able to look downward upon his farm-laborers.

Although he holds his farm as lessee and does not own an inch of it, his occupancy is generally as lasting as he cares to make it, and he is often the direct successor of his father who in turn had succeeded his father, the farm having been occupied, under successive leases, by the same family for several generations.

A recent writer has truly said: "So long as his rent is paid with fair punctuality and his family live decent lives, he may be sure of not being disturbed, and, indeed, he is not uncommonly living in the same house in which his father and grandfather lived before him, and his plows are following theirs along the old furrows."

But he is not particularly social with those outside his own class, nor very communicative. His tastes are not particularly elevated, his ideas are not extensive, and his ambition rarely o'erleaps the limits of his calling.

THE AGRICULTURAL LABORER.

The good minister down in Massachusetts, who in his long prayer at morning service made fervent supplication for the country and its rulers; for the state, its institutions and its people; for the church, its officers and its members, — did not forget, lastly, in his peculiar phraseology to remember "that other dear brother concerning whom we cannot speak so well of." Nor must we. Were the litany of the English Church to be revised and there were added thereto this new petition: "From the hunger, cold, and squalidness of the farm-laborer," I cannot but believe that every humane voice in the kingdom would at once respond, "Good Lord deliver us!"

Yes, the farm-laborer is "that other brother concerning whom we cannot speak so well of." Yet speak of him we must. In

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the English agricultural system the landlord stands at one extreme and the laborer at the other. If you have a clear conception of what the former is, you have but to imagine his direct opposite and you have the latter.

The laborer hires the cottage in which he lives of the tenant farmer. It is as much too small for his necessities as the mansion of the landlord is too large for his. In fact, the one is as mean as the other is splendid. It is of stone or brick, and generally quite old. Its roof is oftentimes of thatch, which, with its small windows and irregular shape, gives it a picturesque appearance, particularly when viewed from a distance. But its dimensions are very contracted. It has but two or three rooms, some ten feet square perhaps, with a loft at times upon a second floor. You enter, most likely, the kitchen, and reach the other apartments through this. The rafters browned by age and smoke are frequently in full view, as well as the straw roof above them. Its stone floor is uneven and damp. Its furnishings are meagre; if they were otherwise there would not be room to receive them. A row of shelves with a small supply of cheap crockery, a cupboard or two, one or two tables with chairs or benches, — these, with the beds of the household, constitute the main articles of its furniture. Unless the family of the laborer is a very small one, the scantiness of his accommodations sadly interferes with the decent privacy of his home. Some years since a commission appointed by Parliament to investigate the condition of this class reported to that body a mass of facts which were as disgraceful to the high parties responsible for them as they were astounding.

Upon looking further we find that, as a general thing, little if any land attaches to the laborer's cottage, upon which, at odd hours, he or his family might raise some portion of the family support, while, at the same time, the rent of it consumes an important portion of his scanty earnings.

His wages vary much in different localities, and at different seasons of the year. The kind of work, and the skill and rapidity with which it is done, affect them. Eight or nine shillings a week were, a few years since, a common price for farm labor in some sections. Latterly, however, wages have risen, and in some counties now stand at double that amount.

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Mr. Richard Grant White, in the last August number of the "Atlantic," speaks of calling unexpectedly and taking tea at the cottage of a laborer who earned twenty shillings a week ($4.80). From this amount he paid two shillings and six pence (60 cents) per week for his rent, having left a net income of four dollars and twenty cents, or seventy cents a day, for the support of his family. Besides this, his wife earned something more for odd jobs of washing as she could procure them. Says Mr. White: "The bread was good, better than that which is sold by most bakers in New York; and they had butter (good also), cheese, and tea, which although not very good was still tea, and quite drinkable when concocted with milk and white sugar, both of which they had of good quality. They had also a dish of cabbage and potatoes, of which I did not eat."

He also remarks: "The landlord of the cottager is not, or is rarely, the squire or lord of the manor. His landlord is the farmer; and my observation and inquiry led me to the opinion that the farmers as a class are disposed to be very hard upon the farm-laborers. It is they who refuse them little garden allotments; it is they who exact rents for miserable hovels which are entirely out of proportion to their value, and to the rent of the ground on which they stand."

In contrast with the condition of things at the cottage just mentioned, which may be regarded as an extremely favorable one, let me direct your attention to that in another, of the opposite character, as reported by Mr. Warren Isham.* Speaking of an interview with a farm-laborer he says: —

"I told him I was an American, and asked him if he ever saw one before.

"'Did you ax me if I ever seed one afore?' he replied.

"'Yes,' said I.

"'No,' he rejoined, 'but I've hearn about 'em, and I knowed some poor men went there and got good farms!'

"'And why don't the rest of you go, and not stay here to starve?'

"'We can't; we only gets just what'll keep us, and tough work at that, and how can we get money?'

"'And what do you live on?'

"'Unbolted wheat bread.'

"'Very good; and what else?'

*The Mud Cabin, by Warren Isham (1853), page 62.

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"'Nothin'; and not enough of that. We only gets seven shillin' a week, and now master is a goin' to put us down to six. One shillin', or one shillin' and sixpence, of it we has to pay for rent, and one shillin' for coal.'

"'But will a shilling's worth of coal keep you warm in winter?'

"'No, it'll only do our cooking; and we can't cook much at that.'

"'And how do you keep warm in winter?'

"'We have to do as we can, and do without fire; we sit in the cold evenin's, and we have but little bed-clothes, and the cold wind blows in, and we suffers with the cold all night; but it's the best we can do, and we has to bear it.'

"'But can you keep a cow and a pig?'

"'No, we gets no land to keep a cow on, and we eats up every thing about the house, and there's nothin' left for a pig.'"

I want in all fairness to say that this record was made by Mr. Isham some twenty-seven years ago, and it is to be fervently hoped that such results have since attended the efforts of Joseph Arch and others of like spirit, to improve the condition of the agricultural laborer, that it will be found true in but very rare instances to-day.

Mr. Escott,* the latest reliable authority which I have been able to consult, says:—

"In prosperous times the wage of the agricultural laborer throughout England averages a little less than eighteen shillings a week, varying from thirteen shillings a week in the South, to eighteen shillings in the East, and twenty shillings or twenty-one shillings in the extreme North, where not only is the rate increased by competition of manufacturing and commercial employment, but the work done is generally regarded as of a higher quality. This weekly wage by no means exhaustively represents the earnings of a capable or active worker, much less of his family, supposing the family to be of industrial age. Both at the time of wheat and hay harvest there are, as we have seen, longer hours of work and higher rates of pay. In the midlands and in the south of England there is the opportunity of supplementing the regular weekly payment by odd jobs of hedging, ditching, and draining, given out as piece-work. Add to this that wagoner, herdsman, shepherd, and any other laborer, who, being charged with the attention of the live stock on the farm, to use the expression already employed, is never off duty, is frequently furnished with a cottage and garden rent-free, and it will be seen that the agricultural toiler is not without substantial perquisites. It is not the case that the introduction of machinery into the processes of harvest have reduced the available earnings of the laborer. 'In the fen districts of Cambridgeshire and Lincolnshire'—Mr. Little is again our authority—'a strong man

* England, her People, Polity, and Pursuits, by T. H. S. Escott. New York: Henry Holt & Co. 1880.

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will consider himself very ill paid if he cannot earn nine shillings or ten shillings a day in following the reaper, and seven shillings or eight shillings when housing corn.' Thus in the autumn of 1877, a family consisting of a man, his wife, a girl aged sixteen, a boy aged fourteen, and two other children of, respectively, eleven and nine, earned in that part of England during a period of five weeks just twenty-five pounds, to which must be added sixteen bushels of gleaning corn picked up by the wife and two girls, and valued at five shillings a bushel. Thus we arrive at a total of near thirty pounds. The normal wages of this man were fifteen shillings a week. As a matter of fact, working for forty-seven weeks out of the fifty-two, he made an average of seventeen shillings a week, and the entire earnings of his family between Michaelmas, 1876, and Michaelmas, 1877, were £97 — 0 s. — 9½d. Mr. Clare Sewell Read once remarked to the writer, that a fair day's work secures its worth in money all England over. Mr. Little's opinion is similar, for he says: 'I shall content myself with the assertion, that as a rule the average amount of weekly wages paid in the country may be taken as no very unfair index of the actual amount of work performed by the average laborer of such districts. Whether the nominal weekly wages are thirteen shillings or eighteen shillings, the amount of actual labor performed bears something like a relative proportion to these sums.'

"In the last week of January, 1879, the wage of an ordinary agricultural laborer may be taken to have been in Essex, Suffolk, and Norfolk twelve shillings to thirteen shillings a week; in the counties of Hertford, Bucks, Berks, and Oxford, twelve shillings to fourteen shillings a week; in Cambridgeshire, thirteen shillings; in the central counties, and from Bedfordshire northwards, at thirteen shillings to fifteen shillings; and in Nottinghamshire and Lincolnshire, fifteen shillings; in Yorkshire it ranged from fifteen shillings at the southern end to sixteen shillings, seventeen shillings, and eighteen shillings, proceeding northwards; and in Durham the rate may be taken as nineteen shillings to twenty shillings, and in Northumberland as twenty-one shillings a week.

"In Cumberland the rate was reported as twenty shillings a week, and immediately adjoining to the Hoematite mines, twenty-four shillings a week, both in Cumberland and Lancashire.

"In the rest of Lancashire, and in the manufacturing districts, and near large towns, the rate varies very much as the population is more or less employed. In the agricultural parts of Cheshire the rate was fifteen shillings; in Staffordshire and Salop it was fourteen shillings to fifteen shillings; in Worcestershire, thirteen shillings to fourteen shillings; and in Herefordshire, twelve shillings a week. In Dorsetshire and Wiltshire the rate may be taken as twelve shillings a week, and in some cases eleven shillings a week; in Somersetshire as thirteen shillings to fourteen shillings; and in Devonshire, twelve shillings a week. Along the south coast through Hants and Sussex the rate was about fourteen shillings; in Kent it ranged from about fourteen shillings in the Weald to seventeen shillings or eighteen shillings near Rochester and Sittingbourne."

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It seems, therefore, from the above statement, that, while in an exceptional case, in harvest, a laborer's family consisting of himself, his wife, a girl aged sixteen, a boy aged fourteen, and two other children of eleven and nine, six in all, earned nearly thirty pounds in five weeks, or six pounds per week, giving to each an average of twenty shillings, the average wages of the whole country, during the last week of January, 1879, was fifteen shillings and three pence, or, in our currency, sixty-one cents per day.

So much as to the wages of farm-laborers. How as to their education? It would be unfair to quote from Isham, for he wrote a quarter of a century ago. I might leave upon your minds a wrong impression, if I related a conversation I had one day, in a railway-coach, with an elderly and very sensible Englishman of the middle class. Taking me for one of his own countrymen, he was speaking of a locality we were just then passing, when something brought to his mind the new provisions which had been recently made for the education of the children of the lower classes. With animation he exclaimed, "What will laborers be worth if educated in that way! It will spoil them. I like to see a man educated for the business he intends to follow. I don't believe in this new system." Although brimful of the notions we generally entertain as to the importance of universal education, and well-nigh to bursting with the pent-up indignation his utterances awoke within him, your speaker succeeded in holding his tongue and has never regretted it. He has thought of his companion's remark a hundred times since. There is much good sense in his terse saying, — "I like to see a man educated for the business he is to follow." That the English farm-laborer will be educated above his station, there can be little reason to fear. Could the children of this country have the education now provided for them brought into closer harmony with the avocations of their manhood, it would be far more valuable to them and a greater credit to the States.

This imperfect glance at the English agricultural system naturally suggests the inquiry, does experience prove this to be the best system yet devised? I do not think it does, and yet it has manifest excellencies. Of these I would note, in passing, three, viz.: —

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1. It elevates farming to a regularly appointed business, which is there more intelligently and systematically pursued than with us.

2. It secures to each farm the combined resources of three distinct classes of men; of the landlord, who furnishes the land; of the tenant farmer, who provides the working capital and manages the business; of the farm-laborer, who performs the required manual labor.

3. It stimulates the tenant to do his utmost and meet his rent, which must be paid when due.

This system is affording the finest farming as yet attained. If any country can be properly designated an agricultural garden, that country most surely is England.

But, at the same time, very serious objections attach to the English system.

1. The farmers hold their farms on leases and for limited times only. They have no permanent interest in the soil they cultivate, and the many improvements which self-interest would suggest, were they its owners, are wanting.

2. These leases quite often contain provisions antagonistic to the tenant's interest. Among them we may, by way of illustration, cite the following, viz.: —

That the farmer must have a specified amount of working capital for every acre he hires. This provision may be a good one in the main, but must at times prove objectionable.

That the tenant shall always keep one-third of his farm in permanent meadow and pasture, without regard to the actual or probable drift of the markets.

That he must in no event deviate from the particular course of rotation specified in his lease.

Where leases are for long periods, stipulations like these often prove very objectionable. The landlord strives to protect his own interests, and in the main, perhaps, succeeds; but agriculture is a progressive business, and its operations require constant changes, which fixed provisions, based upon the experience of less intelligent periods, are very likely to prevent.

3. Under this system nobody is an absolute owner of land, and the interest arising from personal ownership is wanting.

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The *landlord* has in it but a life-estate, and that not unfrequently is heavily charged with annuities or interest payments. The *tenant farmer* holds it but for the limited period fixed in his lease. He has little desire to make permanent improvements the enjoyment of which is uncertain, and which will be likely to increase his rent, if perchance at its termination his lease be renewed. In it the *agricultural laborer*, who spends his life upon the soil, has no interest whatever, and, so far as to the casual observer is apparent, can have but little in anything else. He is a mere agricultural drudge, insufficiently paid, serving first one and then another master in the vain hope of improving a condition of life which is rarely improved except by emigration. For, so long as there is, as now, a surplus of farmers and laborers, competition among them will enable the landlord to rent his lands at prices beyond their true value, and keep labor below a fairly remunerating point.

Strongly marked, you observe, is the contrast between this system and that prevailing in our own State of New Hampshire. Here the ordinary farmer embodies in himself the three distinct personages of landlord, tenant, and laborer. He glories in the thought that the wedge of land which starts as a point at the earth's center and widens as it extends upward to its surface is his; rejoices that within his farm lines he is a sovereign lord. He is willing to be tenant for life of such a heritage. He feels that labor upon the soil he owns is not drudgery, but honorable occupation rather, and a pleasure.

But there is much beside sentiment in farming, and the inquiry arises, does our system afford better farming than the English? Not as yet. Does it afford more profit than theirs? I am confident that it does not. Profit generally varies as the excellencies of culture. Does it afford as equitable a distribution of the rewards of ownership and labor? More so, by far. No careful observer can watch the distribution of farm profits in England without exclaiming with indignation, It is an unequal divide! A brief residence of the English nobility in the cottages of their farm-laborers would convince this favored class of the truth of this remark, and lead to an admission of the very common saying, that, although to the rich man England may be a paradise, it is hell to the farm-laborer.

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I have no wish to extol our system beyond its deserts; no disposition to ignore its deficiencies. I do not forget the stinginess of outlay in his business made by the average New Hampshire farmer, or his lack of enterprise, or the depth of his prejudices. I am conscious of his want of agricultural skill and knowledge, and of the meagreness of his profits. But however small the latter may be, they are more equitably distributed than are farm profits under the English system. The New Hampshire husbandman rarely wrongs any one but his wife or himself. The same cannot be said of the English landlord or tenant farmer.

In many respects English agriculture is superior to that of this or any other of the United States. It is more scientific. It is more thorough. Its operations are more carefully conducted. It is more economical in the use of fertilizers, and has attained to a knowledge, and, to some extent, to the practice of the utilization of the sewage of its large towns, which we allow to corrupt our streams or to run into the sea. It harnesses the steam-engine to the plow and pulverizes the soil to a greater depth than any attained elsewhere. It is honored as an occupation, and held in high esteem throughout the kingdom.

When fairly conducted, farming under our system affords comfortable homes, modest competencies, manliness of character, equality, respectability, and independence. If the farm-house is not a palace, neither is it a wretched cottage of proportions and appointments too scanty for the decencies of home life or reasonable comfort.

It may be hard to say what system is best, as all yet introduced in civilized lands have their excellencies and their defects. It may, however, be said that that system is the best which secures the highest return of profit from the land and most equitably divides it among its owners and cultivators. We cannot hope to realize that ideal when manor-houses and palaces abound, and where seven thousand persons own four-fifths of the whole country. I would sooner look for it in the valleys and on the gentler hills of our own little State, where the palace and the laborer's cottage are structures unknown.

We naturally inquire, are English landed estates profitable investments? If they come to one as a gift they undoubtedly

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are; but the English landlord will tell you that his lands do not yield liberal returns, and pay upon their selling value a net income of only about two per cent. We must not, however, forget that in England three per cent is a fair return from property even less secure than land. Furthermore, if the landlord will persist in paying from fifty to one hundred per cent in excess of its real value for land, on account of the social consideration which its possession affords, he should consider the dignity thus acquired as a part of its return, and add it to the scanty two per cent of rent received from his tenants.

The tenant farmer has little dignity to support, and has usually received a higher cash return upon the capital employed in his business. A profit of seven or eight per cent has been a common one with good managers.

Latterly, however, the tenant farmer has been under a cloud, and much of that cloud is American competition. While the English farmer cannot afford to deliver wheat in Liverpool market for less than one dollar and fifty cents a bushel, his American rival can easily place it there for one dollar and twelve cents a bushel. While the former cannot afford to sell good beef for less than sixteen cents a pound, the latter can make money by furnishing it in the English markets at ten or twelve cents a pound. American cheese has driven hundreds of British cheesemakers to the production of milk, and so increased the supply, as, in London, to lower its price one-third. Barley is now the only grain raised in Great Britain sure to pay a fair profit.

If, under such circumstances, England shall continue to adhere to the principles of free trade, which she has sought to impose upon other nations, we shall be compelled to accord to her a higher saintship in political economy than we have been wont to deem her entitled to.

Were it germane to this occasion, I would be glad to speak of the rapidity with which other American products are appearing in European markets. As it is not, I will merely quote, as bearing upon the subject, a single sentence from the letter of a friend now in Germany who lately remarked: "The other night, at tea, we had Colorado beef, while petroleum lit up the festive board."

The extent of English agriculture is limited and can never be

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greatly extended. On the other hand, that of America may be expanded almost indefinitely. As yet it has only reached the threshold of its career. Its numerous resources have been but partially developed. Millions upon millions of its richest acres have never felt the pressure of the plow, or borne a cultivated crop. But their occupancy is extending every year, and their products are already numerous in variety and enormous in quantity. When, a few years hence, our population shall have doubled, and science and mechanics shall have further improved and cheapened the methods of cultivation, the farmers of the United States will be able, if necessary, to feed, besides the millions of their own, those of all the lands of Europe.

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NEEDS OF NEW HAMPSHIRE FARMERS.

BY HIRAM PARKER, OF LEMPSTER.

THERE are so many subjects and topics of interest that have been discussed at our agricultural gatherings, and by the agricultural press, that one is obliged to hesitate in the choice of a proper theme to interest and profit on an occasion like the present. But the great interest which is being taken in all parts of the country in regard to the rights and needs of farmers, has induced me to consider those which appear the most important, and which should receive the earnest attention of the practical farmer of New Hampshire.

The first important consideration for him who intends to follow agriculture for a life-calling, is the necessity of loving the work in which he is to engage. This, in fact, is necessary in any calling. A physician, if he wishes to become skilled in his profession, must devote the best energies of his nature to his work. This will be the foundation of his success in life ; and what is true of this profession, in this particular, is also true of all other professions, and it is also true of the mechanic, and of every class of business men. It is none the less so with him who follows the plow and scatters the seed, than those in other callings.

When we have once settled upon the farm, and have come to the full determination to make this a life-pursuit, we should manage it in such a manner that it will be a success in a financial point of view. It is an old song that has been sung in the past, and we hear it occasionally at the present time, and we

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have reason to expect it will be repeated in the future, "That farming don't pay." There may be some, perhaps too many, instances, where this is true, and the same may be said, and proved true, of all occupations; it may all depend upon the management of the business, no matter what it may be, for there is none so good as not to require management.

One particular branch of our business is the breeding of better stock and the more careful management of it. We should give it more attention, more thought, and have more information concerning it, so it will be conducted with more system. Of course we do not expect that many of the farmers of the State will be breeders of fancy stock; but what they should do, is to breed that kind most needed by them in their location. My idea is, that a large majority of the farmers of this State cannot breed their stock for any one particular purpose; therefore we must combine the elements of the animal for work, for beef, and the dairy, so far as possible, in order to meet the wants of the average farmers of our State. We need to adopt those breeds that will mature at an early age, for the question is well settled by those who have tried the experiment, and given it much thought, that young animals make a larger per cent growth for the food consumed than older ones. I think this is true of all our domestic animals.

Another important matter is the feeding and care of all the stock kept upon the farm. Of course the winter season requires the most attention. Too many farmers permit their stock to go from the barn in the spring in a poorer condition than they were in the fall, and thereby requiring a large part of the summer season following to get them where they were the fall before. This is poor management and should be corrected, as we think it will be, with the coming progressive farmer.

The question of supplying plant-food is among the first, for the consideration of the practical farmer, at the present day, when we realize what one of New Hampshire's statesmen has recently said in an article on the "Drift of Agriculture," "That every hundred bushels of wheat sold in a foreign market take from the country, in round numbers, one hundred and twenty-five pounds of nitrogen, fifty pounds of phosphoric acid, and

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twelve pounds of potash; and every hundred bushels of corn so disposed of remove ninety-six pounds of nitrogen, thirty-three pounds of phosphoric acid, and nineteen pounds of potash. We are exhausting from the soil, therefore, annually, in our exports of wheat, 45,000 tons of nitrogen, 14,000 tons of phosphoric acid, and 12,000 tons of potash; and our cargoes of corn disposed of abroad transfer to other lands 24,480 tons of nitrogen, 8,415 tons of phosphoric acid, and 4,896 tons of potash. For want of data, I have not calculated the aggregate loss of those leading components of plant-food from our entire list of agricultural exports; but when we consider that the $127,386,676 received for these two prime articles of breadstuffs is but a little more than one-fifth of the income from our entire agricultural commerce, we begin to realize how gigantic must be the drain upon our country in a century, and cease to wonder, that, in the great epochs of history, barrenness should succeed fertility, and powerful nations fade into feebleness, poverty, and subordination. Why, the rivers must run dry if the compensating clouds forget their duty. This is suggestive of our duty; it teaches us plainly that we must in some way or other return to the soil these elements which have been taken from it to produce the crop, in order to prevent a continued exhaustion of our lands. The trouble is, a dollar once taken from the farm is slow to find its way back."

This leads me to say, we need more capital in farming, invested in better farming implements, in farm buildings, in improved stock of all kinds, in some cases the better educating of our sons and daughters. We too often put the income of the farm and the profit of our labor into the savings-bank, or in bonds of some kind, thereby making it useless as far as improving our farms and increasing the fertility of our lands.

It has for a long time been clear to my mind that agriculturists should act more in concert, and in some way be better organized. It is to this class that this nation must look for its food. The thousands of mechanics and artisans who build the warehouses of our merchants, and the ships for our ocean-trade, who toil in the coal and iron mines of Pennsylvania, or amid the busy hum of machinery of our large manufacturing cities, the

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merchants themselves, the professional men in their various avocations, must all virtually depend upon you for their food. This would seem to indicate that you hold all these classes at your mercy; but you well know that such is not the case, but rather the reverse, for in a majority of cases they are the people who run the markets and control the prices, not only of their own wares, but the production of your soil and the fruits of your labor. It is the old story of the white man and the Indian who went hunting and took a crow and a partridge, and in the division of the game the white man didn't say partridge to the Indian once.

Now, what is the cause of this unfair advantage which other classes have been enabled to take over the farmers? We might name many minor considerations, but the all-comprehensive one is, that these other callings are better organized than you are; in other words, they act together, for each other as well as for themselves, while you act separately, each man for himself. It is claimed that the organization of the grange has in a measure corrected these abuses, but there is a large field yet before them, and much work for them or some other organization to accomplish.

There is one duty perhaps more binding upon the farmer than any other; that is, to make his home pleasant. We are invited on one side and another to the consideration of many social wrongs, but I consider their importance insignificant in comparison with the general topic of a model home. We have heard much about the rights of woman, and of course various opinions are expressed, but one right we should all concede to her; that is, the right to make happy homes. Let this right be protected, and it makes little difference whether she votes or not.

You may ask what this has to do with agriculture. Simply this: there is no class of people to whom these homes are more necessary; no class who can more easily secure them than the farmers. I fear too many of them think of their homes only as a place where they take their meals and pass their nights; where they bring their full milk-pails, and buyers to look at the year's butter. In such homes, the question is not how much can be

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done for the children to make them useful and intelligent citizens, not how pleasant and beautiful the house may be, not how cheerful the evenings may be made, but it is how the five hundred dollars in the savings-bank may be increased to a thousand. The question of wealth is all well enough when it is not made simply an end. It is a most excellent servant, but a cruel and relentless master. Men have a higher purpose, and I know of nothing that will forward it better than care of their homes and home relations. Side by side with this, cherish your profession, and act up to the truth that labor is noble.

. . . . . .

There are other points for consideration. We produce more corn per acre than any other State in the Union except California and Kansas, and but few States give more wheat per acre, and only one State more oats, and we raise more potatoes per acre than any other State in the Union. These facts show the strength of our soil, and tell us plainly, that if we will be true to the soil of New Hampshire, the soil will be true to us. Let us bear the facts in mind, and we shall feel as if we were not living in the poorest State of this Union, but think of the oft-repeated saying that New Hampshire is a good State to live in as well as to emigrate from, and not only is it a good State to live in, but a good State to farm in, and if we will do as well by this New Hampshire soil as nature herself has done, we shall be more contented, and love the farm and the farmer's life. To develop these hidden treasures that yet lie buried in our soil, should be the mission of every New Hampshire farmer. No matter how large or how small his farm may be, he should devote his best energies and relax them not, until his fondest hopes have been fully realized. We should understand something of the laws of nature, and not be contented to simply sow and plant in the spring, and in the fall gather in the harvest; but we should know something of the nature of the soil we cultivate, and of the grain we sow, and watch carefully its growth and its maturity, and profit by the result. But recently (comparatively speaking) have the people of this country been startled into action to promote that great interest in which more than one-half of the whole are engaged, and upon the suc-

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cess of which the other portion are dependent. And through the instrumentality of agricultural journals and the establishment of agricultural societies and colleges, have the farmers of this State and of the whole country been brought to discover that there is work for them to do outside of the limits of the farm. They seem to have been startled into a determined purpose to take their proper place in the march of the world's progress, and to assert for themselves a position which will enable them to keep pace with all others whose goal is success in life. All this is as it should be, and the only danger is that we shall be contented with a partial progress.

I have said that the agriculturists are more numerous than any other class, yea, than all other classes of our citizens, and they are capable of wielding, and do wield a mighty power in the State and nation for good or for evil. How important then, brother farmers, that we all know how to wield that power for good. We are entitled to a representation in our state and national councils, proportioned to our numbers. But has this right ever been conceded to us? No, for we have never claimed it; and we may rest assured that till we learn to respect ourselves and our rights, others will never respect them. Have we not too often been flattered by the honeyed words and fair speeches of political quacks and demagogues who had no common interest or feelings with us, into the support of men and measures which were against our best interests, and the best interests of the public at large? Have not too many corrupt and unprincipled men who followed no regular and useful business or occupation in life, through false pretensions and flattering appeals to us, by our own unpardonable ignorance and remissness, obtained offices for which they were utterly unfit, who only sought them for the loaves and fishes, to drive sharp and corrupt bargains or fatten upon the public bounty?

I make these remarks not for the purpose of exciting jealousy or ill-will, or arraying one class against another, but what I wish is to emphatically impress on your minds the importance of fully understanding *where*, for *whom*, and *why* you give your votes; of voting for no man unless he is capable, honest, and faithful; if you know him to be such, let his occupation be what it may, give him your support.

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One important duty devolving upon agriculturists is that of providing for and properly educating their children. Without this farmers will never attain their true position in society, nor exert the influence and maintain the standing to which by their numbers and pursuits they are entitled. By *education* I mean something broader and more comprehensive than mere literary acquirements, or a knowledge of books and science. Your children should be taught good morals, respect for the aged, habits of industry, frugality, purity, temperance, and charity. To these necessary and practical lessons add as much other learning as possible without detriment to any of these. I care not how deeply learned farmers' sons may be in philosophy, history, botany, mathematics, languages, or the sciences generally, or how highly accomplished and refined the education of their daughters in music, painting, French, Italian, or other languages; the more the better, if to these is added the necessary and practical education first mentioned. A farmer's son should know how to turn a furrow with a plow, rear cattle, fatten swine, swing a scythe, how to economize and procure a living, or he is poorly educated, and will make a poor figure in the world. And so with the daughter that lives upon the farm. She should have a practical education, or she is a poor piece of furniture in her father's house, and will be in her husband's, if she ever gets one. Then let the foundation of the education of your sons and daughters be laid deep, strong, and sure, and rear the superstructure as high, and ornament it as well as your circumstances will warrant; but never lay the foundation in gold-leaf and then attempt to finish the building with a ponderous block of granite. But if we have any respect for the rising generation, and any pride for our calling, let us not advance the idea that in order to have our sons and daughters settle upon the farm, and become practical farmers, their education should be limited, or that they of necessity require but a small amount, for this will drive from the old homestead, and from farm-life, every young man and woman who has that amount of ambition which young people of the present day should possess in order to succeed in the battle of life. We do not expect, nor do we wish, to have all our sons and daughters attempt to make farmers or farmers' wives, for some

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of them were made for something else, and there is no use in attempting to make a chicken swim, or a duck perch upon the roost; but if we have chickens let us give them a place where they can perch at night, and if we have ducks let us give them a place where they can swim, thereby gratifying the natural instincts of their natures. So with the young and coming generation: if they love the farm and farm-life, let us see that they have a farm to love and a farm to work.

I have but briefly hinted at some of the more important points, which, as they appear to me, should receive our attention, and some of the improvements the times demand of the tillers of the soil all through the State, and through the country; and if we are true to ourselves, to our homes, to our State, and the noble calling in which we are engaged, domestic songs will go up from every home in our valleys and on our mountain slopes, and we can in all sincerity say with Goldsmith, —

"Dear are these homes, to which the soul conforms,
And dear these hills that lift us to the storms;
And as the child, by scaring forms distressed,
Clings close and closer to the mother's breast, —
So the wild tempest and its wintry roar,
But bind us to our native mountains more."

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METEOROLOGY.

BY DR. HIRAM A. CUTTING, OF LUNENBURG, VT.

OBSERVATIONS made in the interests of meteorology, and collected and reduced under the patronage of our government, have shown that though our storms are irregular, that our hills and valleys are rendered fertile by the moisture brought from the Gulf of Mexico, by the great south-west current. This is modified by the physical contour of the country, and by the great atmospheric current coming from the Pacific, which, though it loses most of its moisture before it reaches us, modifies our climate, as we get westerly winds at least three-fourths of the time; and sometimes when we get falling weather, this wind, meeting the moisture coming inland from the Altantic, condenses it, causing showers, and now and then extensive storms. Thus the atmospheric disturbances, generated thousands of miles away, give us, in connection with our local storms, sufficient moisture to render the State fertile, even to the mountain summits.

Through the investigations made by the late Prof. Joseph Henry, of the Smithsonian Institute, we see that our great north-east storms have their origin within the tropics. The great current of the south-east trade-wind infringes on the north-east trade-wind, and produces the cyclones so destructive on the coast of Florida and the West Indies. The cyclone thus generated moves along the coast with diminished violence, producing our north-east storms. Sometimes this disturbance originates among the Rocky Mountains, sweeping over the continent. This takes place oftener in August, or midsummer;

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while in autumn and winter we are more dependent upon the gulf storms. From observations of the Signal Service, it is shown that from seven to thirteen areas of low barometer are developed per month within or upon the borders of the United States. From one to three of those pass directly over Vermont and New Hampshire. As a rule, rain-fall increases as you go towards the equator, and decreases towards the poles; thus we should expect more rain-fall in the southern part of the State, and such is true, yet its geographical distribution depends somewhat upon the contour of the State. Though they may receive more rain, it is in no way certain that they may not more often suffer from drouth than other sections, as the nature of the soil and the greater or less humidity of the atmosphere from surrounding forests or ponds may much modify evaporation. The amount of vapor in the atmosphere regulates the intensity of the sun's rays, as well as prevents the radiation of the sun's heat from the earth, which radiation rapidly aids evaporation of moisture. Thus in some sections crops may severely suffer from drouth, while in others they may not, yet the rain-fall for the time may be equal. Thus it will be seen that the preservation of vegetation upon our hill-tops and mountains not only modifies the effects of drouth, but, carrying out the same reasoning, moderates the extremes of winter. In relation to soil, it is easy to ascertain which will retain the most moisture, by taking a given amount that is perfectly dry, and see how much water you can add to it without its leaching, and then how rapidly it loses it by evaporation. These experiments show that while the usual soil of our hill-sides is losing three-fourths, that of our valleys, which will not at first retain as much, will lose nine-tenths of what it at first absorbed, thus showing why the hills are more often green, and hill-land more sure not to suffer from drouth.

The greatest amount of annual rain-fall seems to be about the highest of the White Mountains. It is set down at fifty-five inches, but the rain-fall for 1876 was seventy-eight inches. It is probable that fifty-five is none too high for the average. The next largest is in Central New Hampshire and Southern Vermont, being from forty-four to forty-six inches, shading north-

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ward in Vermont to thirty-eight, thirty-nine, and forty inches, while an area west of Lake Champlain has but thirty-seven inches.

In comparison with other places, this seems a small amount. The average annual rain-fall in Calcutta is one hundred and eighteen inches; on the Amazon River, five hundred inches; in Guadaloupe, two hundred and eighty-two inches; in Singapore, one hundred and ninety inches, and many other places equally large: but the general summary of observations throughout the world establishes the fact that within the tropics the average amount is about one hundred inches, and the average number of rainy days, eighty; in a belt including the Southern States, seventy inches in one hundred and twenty-five rainy days; in a belt from the Southern States to Northern Vermont and New Hampshire, forty-five inches in one hundred and fifty-six stormy days, while the average fall in Siberia is only five and one-half inches in two hundred stormy days. A small amount of rain if at proper intervals is sufficient for vegetation. Our amount of rain-fall is as well calculated for production as that of any section of the globe. It much exceeds many sections of the fertile West, and is much more constant from year to year.

The following table shows the amount of annual, as well as monthly, rain-fall at fourteen stations in New Hampshire, most of them being for a series of years.

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TABLE OF RAIN-FALL.

COMPILED FROM MANUSCRIPT RECORDS, SMITHSONIAN TABLES, AND OTHER AUTHENTIC SOURCES.

Names of Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Annual Rain-fall.
Ashland	4.02	3.56	3.70	3.38	3.39	2.50	4.32	4.18	3.77	5.54	4.57	3.57	10.47	11.00	13.88	11.15	46.50
Bristol	3.84	3.58	4.38	3.41	3.03	3.02	5.12	3.50	3.55	5.51	3.84	3.30	10.82	11.64	12.90	10.72	46.08
Claremont	2.96	3.26	4.99	3.32	3.96	2.93	3.94	4.92	3.51	4.15	2.38	3.37	12.27	11.79	10.04	9.59	43.69
Concord	2.92	3.34	2.38	3.49	3.97	2.72	3.68	4.17	3.43	4.26	3.62	3.01	9.84	10.57	11.31	9.27	40.99
Hanover	2.86	2.70	2.98	3.13	3.46	3.89	3.41	3.79	3.17	4.01	3.40	3.52	9.57	11.09	10.58	9.08	40.32
Lake Village	3.41	3.55	3.15	3.69	2.48	2.59	4.66	3.38	4.19	4.33	4.55	2.80	9.32	10.63	13.07	9.76	42.78
Londonderry	3.69	3.93	2.47	4.50	5.53	2.33	2.07	4.89	2.07	5.26	5.01	3.86	12.50	9.29	12.34	11.48	45.61
Manchester	2.74	3.94	2.07	4.78	4.83	1.94	2.86	6.33	3.84	3.68	4.06	4.10	11.68	11.13	11.58	10.78	45.17
Meredith	3.38	3.08	3.08	4.75	3.66	2.52	3.41	3.08	4.41	5.12	4.56	2.86	11.49	9.11	14.10	9.33	44.03
Mount Washington	1.67	.29	.83	.07	4.62	18.46	3.59	6.33	9.56	6.10	3.52	.85	5.52	28.37	19.08	2.81	55.79
Portsmouth	3.39	2.47	2.04	1.01	3.02	2.72	2.20	3.41	1.99	3.76	2.29	1.58	6.07	8.33	8.04	7.44	29.88
Stratford	2.77	2.52	3.47	2.48	3.31	3.24	4.42	3.84	3.98	3.64	3.21	3.08	9.26	11.50	10.83	8.37	39.96
Weirs	3.63	3.67	3.84	3.02	2.45	2.94	4.59	3.58	3.83	4.24	4.06	3.01	9.31	11.11	12.13	10.31	42.86
Wolfeborough	3.53	2.81	4.01	3.32	2.18	2.67	4.85	3.84	2.45	4.20	3.66	2.44	9.57	11.36	10.31	8.78	39.96

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TEMPERATURE.

As the sun's rays are perpendicular at the equator, and strike at a regular increasing angle as we approach the poles, it would seem evident that there would be an equally decreasing degree of temperature, yet such is not the case. We find that latitude is by no means a sure criterion of heat and cold. The equator should thus be the warmest section of the earth, but such is not the case, the warmest place on either continent being about ten degrees north of the real equator. Also the cold at the poles, not as might be expected at the poles themselves, but about fifteen degrees from them, and beyond that impenetrable ice barrier is open sea. Again, the lines of temperature are by no means regular. England, six or eight degrees farther north than we are, has a climate warmer than New York city. And Quebec, on the St. Lawrence, has as cold a winter as the interior of Siberia; while Canada West, in higher latitude, is as warm as Massachusetts, and the winter is full six weeks shorter than at Quebec. Still the summer at Quebec is as warm as the summer of Italy, where snow never falls. Thus we see how the lay of the land, and the currents of air and of water, affect climate quite as much as latitude. In a hilly State like New Hampshire, the streams of cold in the winter are nearly as regular as the streams of water in the summer. The air in contact with the earth becomes colder, and for that reason heavier, and so flows down the valleys like streams of water. In the Connecticut-river valley runs down a great stream of cold air, making quite regular temperature in winter the whole length of the State, and bending the annual temperature lines at least fifty miles farther south in that valley than on the hills.

THE ATMOSPHERE.

It is desirable that all should have a general understanding of our atmosphere, and the laws by which our storms are regulated or produced, and to render such instructive I shall say something of the history of Meteorological Science, and also of familiar signs, as well as instrumental observations. Two hundred and fifty years ago it was not known that we had an atmosphere. All the phenomena it produces were explained upon other prin-

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ciples, some of them showing the wildest theories and the most absurd ideas. The creation of the atmosphere as declared in Genesis, as the "firmament" dividing the waters, was not understood. A vague and unmeaning explanation was given it. When it was discovered that there was in reality an aeriform fluid surrounding the earth, possessing weight, color, power of diffusing light and heat, and necessary to the existence of all animal and vegetable life, it struck with wonder and astonishment all the learned throughout the world. So wonderful and incredible did it at first appear, that it was not until after the lapse of several years, till opinions which had prevailed for ages were overthrown, and the most decisive experiments had been performed in every possible way, that it was cordially received. This atmosphere is composed mainly of two gases, nitrogen and oxygen. It was, however, less than eighty years ago, supposed to be a simple body, but is now known to be composed of about eighty parts by measure of nitrogen, and twenty parts of oxygen. It may be necessary to offer a few remarks on these gases, opposite in their nature; entering into no chemical union, yet being combined in so exact proportion as to support animal and vegetable life, and the smallest change, perhaps, detrimental to either. Oxygen gas is eminently the supporter of combustion, and ignited substances burn within it with the most intense brilliancy. Even shavings of zinc and iron may be ignited, by dipping the ends in melted brimstone, and introducing them into this gas while the brimstone is on fire. They then burn with intense heat and give a peculiar light, exemplifying the fact that if our globe was surrounded by an increased amount of oxygen, many now incombustible substances could be burned.

Nitrogen gas is exactly opposite in quality. It will extinguish fire as well as water, and will soon kill any animal that breathes it uncombined with oxygen. Yet four-fifths of the air we breathe is this noxious substance.

Oxygen is the life-giving element, and as this is largely consumed in combustion and respiration, and by those processes replaced by an equal volume of carbonic acid, which is detrimental to animal life, it would seem that the atmosphere would at length become deleterious. This would be the case, were it

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not for vegetation, which by aid of the sun's rays absorbs the carbonic acid, and gives off, after the appropriation of the carbon, oxygen for the animal. Thus the animal and vegetable mutually support each other; I say support, as breathing affords three-fourths of our own nourishment, leaving the other quarter, only, to be supplied by food. With this unceasing metamorphosis in beings and things, goes on a continuous exchange, by virtue of which the gases of the atmosphere take up their abode in animal and plant. Each atom of air, therefore, passes from life to life as it escapes from death after death, being in turn wind, flood, animal, plant, or flower, being successively employed in the composition of thousands of plants and animals.

It is the inexhaustible source from whence everything that lives draws much the largest share of its support, and into which everything that dies contributes. Under its action vegetables and animals are brought into existence and then perish.

Life and death are alike taken in at every respiration, and the atom of oxygen which escapes from the blade of grass may find its way into the lungs of the infant in the cradle; or the last sigh of a dying man go to nourish the brilliant petals of a flower.

WIND AND STORM.

We know wind is air in motion; this of course could not be known when it was not known that we had an atmosphere, so by the ancients entirely different causes were supposed to produce it.

Pliny, one of our greatest historians, being thoroughly reliable as regards the facts of his day, says: "In houses there be hollow places devised and made by men's hands for receipt of wind, which being enclosed with shade and darkness, gather their blasts." Thus in the time of the ancient Greeks; in the time of renowned men that invented an architecture, or manner of finish, which has been handed down and used to the present day, building their houses and their stately edifices with curiously contrived cavities on the outside, as a resting-place for wind. Wind to their minds was a spirit needing their protection, and one to which they did not wish to give offense. They supposed his abode to be in the mountains of the North which divided

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their country round about the Mediterranean from the country of the fabled Hyperboreans in the North, and that when displeased they hurled down the north wind, which was chilly and cold to the inhabitants of a more southern clime.

Caves were places of superstitious dread, as they were supposed to be the resting-places of wind, and finally became of use to the free-booters, as they were thus comparatively safe from the law. We learn from many ancient histories similar facts. The origin of wind as taught to their youth, and handed down to us in their ancient manuscript school-books, is this: "There be certain caves and holes in the earth which breed wind continually without end. They have wide mouths, and if you cast in anything of light weight, it will be seen presently to come out with a stormy tempest. Thus you can see how all winds have a cause." That all winds have a cause we are ready to admit, but that they understood that cause no one can now believe. Even to-day we are in doubt about some of the causes of atmospheric disturbances. We know, however, that heat and electricity, as well as the revolution of the earth, and atmospheric tides, aid in the development of winds and storms.

Though all parts of the earth's surface have atmospheric currents of more or less force, there is great contrast in different sections. The northern half of the Connecticut-river valley, shut out by the White Mountains on the east from the oceanic currents, and by the Green Mountains on the west from the strong west winds of the continent, has aerial currents strictly local, and of mild force. The winds prevalent around Lake Champlain even, would be considered extraordinary gales here, while in many sections of our fertile West the wind blows every day so as seriously to impede labor, while in many places peculiar winds and violent hurricanes pass, frequently causing great inconvenience, and many times fearful loss of life and property. Though your quiet State is seldom visited by tornadoes, there has been a sufficient number to show that you are not exempt.

While tornadoes are rare, hail-storms in some special sections are of more frequent occurrence, and are usually electrical. But what electricity has to do with the formation of hail-storms is not so clear. All we know of the nature of electricity is that it

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is a mighty force, called, for the sake of convenience, a fluid. It appears to exist in every substance in nature, in both solids and fluids, and may be roused from its repose by a variety of causes, such as friction, heat, and chemical action. But we are totally ignorant of the reason why these causes excite it. When thus aroused it often displays tremendous power, and sometimes produces the most destructive effects.

In the formation of a thunder-shower two or more clouds will first be seen, and seeming to attract each other, they approach within a certain distance, when their electricity begins to accumulate on the sides nearest each other. When this accumulation becomes sufficiently intense to overcome the resistance of the atmosphere, discharges take place, causing thunder and lightning. The same also frequently takes place between the clouds and the earth, in which case the lightning may pass both upward and downward.

The lightning is first seen, because light travels with immense velocity, while sound travels only 1,142 feet per second. Thus it may be seen that if four and one-half seconds intervene between the flash and the report, one mile intervenes between the discharge and the observer. In this way the distance can always be ascertained unless the cloud is more than ten miles distant, in which case, in ordinary circumstances, no thunder will be heard This sublime and terrific phenomenon is well known to every individual, as it is occasionally displayed in every region of the globe. A thunder-storm usually happens in calm weather, though they are sometimes accompanied with furious winds. The dust-storms of Africa and India are also accompanied with much thunder and lightning. There is a peculiar circumstance sometimes attending thunder-showers that converts them into hail-storms, as before mentioned. The clouds in some cases seem to be very high, or carried up by the wind beneath, until, from their elevation, the water they contain may become frozen, and fall to the earth as hail. They are sometimes frozen very rapidly, the hail falling in all possible shapes, but generally the hail-stones are round or oblong in shape, and when broken open seem to be frozen round a snowy nucleus, frequently as well-formed as a snow flake, being star-shaped, like a large variety of

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our snow-storms, showing that snow was first formed from a part of the water, every flake forming a nucleus for the formation of the water around it into a hail-stone. In other cases the hail seems to result from a purely electrical condition of the clouds, which in some way furnishes the cold necessary to freeze the rain-drops.

The atmosphere, aided by various disturbing powers resulting in wind, and its remarkable avidity for water known as evaporation, distributes moisture to the earth as dew or rain, rendering it fertile wherever this moisture is deposited. The most simple form of deposition is that of dew. This is the humidity of the atmosphere deposited on surfaces with which it comes in contact. During the day the solid portion of the earth becomes more heated than the atmosphere, and gives off moisture by evaporation. This continues to go on until the solid portion becomes cooler than the air; then this moisture is in part condensed on the solids, forming dew. Dew can be artificially formed at any hour of the day, as for instance: Take a pitcher of ice-water, or cold spring-water, and place it in the open air, or in a room in your dwelling, and the outside of the pitcher will in a short time become covered with drops of water. The general term given is that the pitcher sweats, and some even suppose that the water sweats through the pores of the pitcher. But such is not the case; it is dew, the same as deposited on the grass or ground, and from the same cause. Warm days and cool nights are favorable for large dews. I might almost say fair nights, for cloudy nights are always cooler, and sometimes, and in fact often, cool the atmosphere as fast as the earth cools, in which case there can be no dew. This shows an atmospheric change likely to be followed by rain. The atmosphere always contains more or less aqueous vapor in an invisible form. This vapor is water dissolved in it, in the same manner as refined sugar can be dissolved in water without changing its transparency. As warm water will dissolve more sugar than cold, so will a warm atmosphere dissolve more water, or, in other words, retain more vapor. If the temperature is depressed, the vapor appears in the form of clouds. If greatly cooled it will fall as rain, hail, or snow. This principle of evaporation and deposit

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of moisture, now so generally understood and so thoroughly demonstrated, was once, like all other points in meteorology, considered as beyond comprehension, and attributed to supernatural causes. Horace speaks of dew as a gentle evening shower without clouds. Virgil says that every night we have a misty rain. Pliny speaks of the falling dew; and even at the present day how often do we hear the expressions about falling dew, showing that though we understand the principle and manner of deposit, we are not entirely free from the idiom of expression founded on the mythic reasons of past ages. Some countries are rendered productive and even fertile by dew alone, and doubtless this to the ancients being so mysterious, being deposited in greatest abundance where most wanted, and of vastly more importance to them than to us, caused them to regard it as an express gift of God, as the manna in the wilderness, by his hand, but not in accordance with the laws of nature. In the minds of those people it possessed wonderful virtues. It was supposed if man sipped the dew, and drank no other beverage, he would possess new vital energies, and live on the earth a very long period, if not forever. Even up to the present time it is considered by some to beautify the complexion and restore the charms of youth; while by the alchemist of olden time it was supposed to be a solvent of mysterious power. In fine, almost everything possible or impossible has been ascribed to its many virtues. In ancient philosophy it is described as the tears of the gods, and by all ancient nations as a gift from heaven. Thus we can see why, when the blessing of Isaac was conferred upon his son Jacob, he used the expression, "God give thee of the dew of heaven." In the East it was much more abundant and important than with us, although of great importance here.

It begins usually to be deposited as soon as the sun goes down, and frequently before, and continues through the night. When the temperature decreases during the night to the freezing-point, the dew is frozen, forming frost, its destructive powers being in proportion to the intensity of the cold. The glistening appearance on the surface of snow, are dewy particles frozen into beautiful prisms; when the sun shines upon them in the right direction they will reflect all the colors of the rainbow.

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Dew is deposited in all the fertile regions of the earth, but in sandy deserts, where the heat of the sun is so intense, the burning sands are never cool enough for its deposit. A desert is, therefore, not only a rainless tract, but a dewless one. This deposit not only varies greatly with the season, but in different sections much in amount.

The dew in this section amounts to about three and a half inches of water per annum. In Europe to about five.

Dew is, as we have seen, the most simple form of disseminated moisture; yet simple as it is, it is very efficient. Indeed, every shrub and herb, every leaf and blade of grass, possesses according to its wants a different power of radiation, so that each condenses as much dew as is necessary for its own individual wants. Thus not even a single dew-drop seems to have been formed by the rude hand of chance, but it is adjusted by the balance of infinite wisdom to accomplish a definite and benevolent end.

CLOUDS.

The next means of disseminating moisture is by clouds. Their formation I have already explained. They are not vapor, as vapor is invisible, but water. Not held in solution, but in minute particles, supposed to be hollow globes, as fine as floating dust. In reality, water pulverized, — so light that they may be readily blown forward by winds, yet ready to be condensed and precipitated as rain by the slightest causes. This condensation is commonly produced by reduction of temperature, either by a cooler current of air or by electrical changes. Clouds are continually varying in their form and appearance, but may be classed under four heads.

THE CIRRUS

is a light, fleecy cloud resembling a wisp of hair or bunch of feathers, and is the highest of all clouds. The water it contains is of course frozen into snowy particles on account of its great elevation; and further, we know it is so, as aeronauts passing through it in their balloons always find it so, and its peculiar appearance is owing to that fact, as the wind blows the frozen particles about in long, wavy lines. When this cloud is seen, if

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it be watched, it will gradually change into a sort of dappled sky or wavy cloud, and disappear, or else the length of the lines will increase and expand over the heavens; in this section the resolution into the mottled sky indicates fair weather, but the last-mentioned form indicates a storm, which will be likely to come in three days or less. Still, when we have had a storm, and these clouds are seen, it is a sure indication that the storm is about to abate, and for that reason they are termed by some fair-weather clouds. Second,

THE CUMULUS

is the common cloud wafted about by the wind, sometimes piled up in the horizon so as to look like snow-capped mountains, or like ocean billows lashed with foam. If those clouds move off and appear high above the mountains, fair weather may be expected; but if the lower edges are smooth, and they hang around our mountains, look out for storms, for they then have to settle but a few feet nearer the earth to become rain-clouds. In summer they produce many showers, especially when the weather is hot; as evaporation is rapid they increase in size, and sinking nearer the earth they discharge their contents with thunder and lightning. You can usually tell something of the state of the atmosphere and probabilities of a storm by watching a small cloud of this description. If it increases in size and assumes a darker tint, it indicates a storm: if, on the other hand, it decreases, it indicates fair weather, and if it be entirely dissipated no storm may be expected; but if dissipated rapidly look out for showers, as the electrical condition of the atmosphere is such that they may be produced as soon as evaporation supplies the requisite amount of moisture. Third,

THE STRATUS

is a horizontal misty cloud, frequently observed in a summer evening lying across the country, slightly elevated, and apparently having no motion, also along rivers and over ponds, where it is known as fog. It is usually dissipated by the sun in the early morning, but is sometimes in sufficient quantity to produce rain, but in this section is generally a fair-weather cloud. Fourth,

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THE NIMBUS

or rain-cloud has a uniform gray color, has fringed edges when they are seen, but usually covers the entire sky, and the rapidity of the rain depends on its thickness. The nearer the ground the greater its probable thickness, and the more water contained within it. All know this cloud, in a moment, as it always produces rain. With us it is a common cloud, but in many sections of our globe it is never seen, as extensive tracts of land exist where rain never falls. Some of this land is rendered productive by the overflow of rivers like Egypt, others by copious dews like some parts of Arabia, but by far the larger portion of the rainless districts are barren deserts like Chili and Peru, or the great desert of Africa or Arabia. On the other hand, within the tropics where the great cloud belt that continually encircles the earth swings gradually north and south, changing their seasons from wet to dry, there are places where rain and mist continually fall; but as those tracts are among islands or upon the ocean, they are of little account. The island of Tahiti forms a striking example; rising out of the tropical ocean to ten thousand feet above its surface, it forms a nucleus for the condensation of clouds, and the thickly wooded sides are well fitted for rapid evaporation by the hot winds of the ocean, so there goes on with great power rapid evaporation and incessant rain. The amount of rain which usually falls in this locality, in a rainy day, is seldom over one inch, and generally much less. The entire fall of water, including melted snow, is on an average not much above forty inches. We are, however, like other countries, liable to very great

IRREGULARITY OF STORMS,

and on some rare occasions as many as four inches have fallen in twenty-four hours, as on the 3d of October, 1869. With this exception we have not for twenty years had over two inches in twenty-four hours, and that only seven times during this period. These were all remarkable rains. As it takes a foot of snow to make an inch of water, you can see our winter storms are much less than those of summer.

Many instances are recorded of fish, frogs, and a great variety of animal and vegetable substances, falling from clouds. These

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are sometimes taken up by waterspouts and whirlwinds, and in countries where those are prevalent are of no rare occurrence. Again, substances resembling flesh form in the atmosphere, as in the Kentucky meat-shower of 1876, which was this peculiar substance. Or like the vegetable manna that fell in Russia in 1817, in sufficient quantities to afford food for cattle, and even for man, and form an article of traffic. Between twenty and thirty showers of blood are recorded in history; but when this blood has been examined by scientists, it has been found to be red earth mixed in the rain-drops, and of course cannot be unusual where the bare red earth covered with soil impregnated with iron is exposed to violent winds, capable of raising the fine particles to be brought to earth in rain-drops.

Showers of sulphur, so often recorded, are almost always the yellow pollen of the birch or pine. But we will leave these curious freaks of nature, and look more particularly to our own climate.

The Smithsonian Institute, with a corps of observers throughout the world, endeavored to establish a theory by which coming storms could be predicted. Though they failed in accomplishing all they hoped to do, yet it became evident that by a series of observations taken in different sections, by competent observers, much might be gained, and by telegraphing such observations to a central point the progress of storms could be known; and the telegraph could convey in advance the probable force and effect of coming storms. It was at once seen that such an arrangement would greatly benefit the shipping off our coasts, and the agriculturists of our country; and the war department, in connection with the post-office department, organized a service for the purpose of conveying such information over the country for the benefit of all. Though the appropriations have been entirely inadequate for the work, much has been accomplished and millions of dollars saved.

As I have before stated, most of our storms commence far south or west. We frequently receive notice from the Signal Service, stating that such a storm is coming, when the heavens are unclouded, and nothing but a slight decline in the barometer indicates its approach. Many of those storms expend their fury

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before reaching us, and a cloudy day only will show their previous existence.

HOW TO FORETELL STORMS.

To the agriculturist the ability to foretell, even for a day, the approach of a storm, is many times of great advantage. I much regret that all are not able to derive that knowledge from the Signal Service reports; but as such cannot be at present, I will explain the uses of such instruments as will aid in forming a reliable conclusion as to the probabilities, many times amounting to an absolute certainty, of a coming storm, and then mention the reliable signs, without instruments, which my observations have established as worthy of note.

First, it is necessary to ascertain the amount of water held either by saturation or clouds in the atmosphere. If the atmosphere in this latitude is thoroughly saturated, it may contain about eight inches of water, all invisible to the general observer; yet with such a degree of saturation the heavenly bodies will appear somewhat dimly, and as water is a much better conductor of sounds than air, sounds will be more readily transmitted. People will notice the difference, and call it the sign of a storm. It shows a fact; that is, that a large amount of moisture is contained in the atmosphere. But as without instruments the amount of moisture must become a Yankee guess, it will not answer for the scientific observer. He must have something more tangible.

With the common uses of the thermometer all are acquainted. At first thought it would seem impossible that the thermometer could be used to show the exact amount of moisture, as well as heat, in our atmosphere, yet such is the case. If we hang two thermometers side by side, they will indicate the same temperature; but if we cover the bulb of one with fibers of silk, and saturate it with water, we shall find that the evaporation of the water will produce a greater degree of cold, and that thermometer will fall, sometimes as much as 8° or 10°. Now it is found that when the thermometers stand several degrees apart that the atmosphere is very dry, and consequently evaporation is rapid; but as it becomes saturated, and evaporation less rapid, the

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thermometers will more closely coincide, and when evaporation can go on no longer, the atmosphere containing all the moisture it can, they will then be exactly alike; but, of course, rain is imminent. This instrument when put up in proper form, with tube to contain water to keep the bulb of one thermometer constantly wet, is called a psychrometer, and is an important instrument to the meteorological observer.

Tables have been constructed so that the exact amount of moisture contained in the atmosphere can, in connection with this instrument, be always known; but as a large amount of moisture may be long retained unless there is some decided change, we have to look to the barometer for guidance. With this instrument there is one general direction, which if allowed to have full scope would obviate many difficulties. That is, the rise of the mercury from any point denotes less wind, and a general improvement in the atmosphere, with less inclination to storm. A fall from any point indicates wind and storm, or a condition of the atmosphere more favorable to such. But as wind, rain, or snow affect the barometer in the same manner, how are we to prognosticate which will take place? Here we receive aid from the psychrometer. If, when the fall takes place, the atmosphere is fully saturated with moisture, of a necessity this moisture will, in part at least, be condensed and fall; if, on the other hand, the atmosphere contains but little moisture, wind only will result, yet the fall may be equally great. By this you will see that those two instruments go hand in hand if you would form a good judgment. Yet to the person possessing only a barometer, I would say that a due reference to the direction of the wind, the formation of the clouds, and the temperature of the atmosphere, will give sufficient data upon which to predicate a reliable opinion.

SIGNS OF RAIN, VISIBLE AND INVISIBLE.

A hunter, ere the sun dispels the fog of a mucky morn, builds his camp-fire in the forest. The stifling smoke arises from damp and half-decayed fagots. His culinary duties release the fragrant odors from eggs and bacon, while frying onions still send forth their aroma, mingled with the sweet-williams, violets,

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and blue-bells at his feet. His dogs sniff the air, and from this medley of smells scent a fox, and start upon its trail, while another follows a rabbit. In this is a lesson for the thoughtful; humidity, smoke, stench, and odors of a hundred kinds, arise and impregnate the atmosphere which previously occupied the whole space, and many contend that the relative gases in the atmosphere are unchanged. Then we have the anomaly of a vessel a hundred times full without once emptying. This also illustrates how the atmosphere may become, all invisible to us, the vehicle for the conveyance of moisture.

It has been ascertained by experiment that when the atmosphere is fully saturated, it may contain as much as thirteen grains of water to the cubic foot; all invisible to the naked eye, if at eighty-six degrees of temperature. Now, how shall we ascertain its presence? The barometer and psychrometer aid us, but are not always at hand. Common observations have established in the minds of all certain signs of storm, which have in many cases a foundation in scientific fact. The following lines first published many years ago, and emanating from an unknown pen, embody many of those, and so I reproduce them as a text upon which I can offer explanations: —

"The hollow winds begin to blow,
And the barometer is low
The soot falls down, the spaniels sleep,
And spiders from their cobwebs peep.
Last night the sun went pale to bed,
The moon in halo hid her head.
The clouds look black appearing nigh,
And see, a rainbow spans the sky.
The walls are damp, the ditches smell,
Closed is the pink-eyed pimpernel.
Hark how the chairs and tables crack,
Rheumatic joints are on the rack.
Loud quack the ducks, the sea-fowl cry,
The distant hills are looking nigh.
How restless are the snorting swine,
The busy flies disturb the kine.
Low o'er the grass the swallow wings,
The cricket, too, how sharp he sings.
Puss on the hearth with velvet paws,
Sits wiping o'er her whiskered jaws.

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The smoke from chimneys right ascends,
Then spreading back to earth it bends.
The wind unsteady, veers around,
Or settling in the south is found.
Through the clear stream the fishes rise,
And nimbly catch the incautious flies.
The glow-worms numerous, clear and bright,
Illumed the dewy hill last night.
At dusk the squalid toad was seen
Like quadruped, stalk on the green.
The whirling wind, the dust obeys,
And in the rapid eddy plays.
The frog has changed his yellow vest,
And in a russet coat is dressed.
The sky is green, the air is still,
The mellow blackbird's voice is shrill.
The dog so altered in his taste,
Quits usual food on grass to feast.
Behold the crows, how odd their flight!
They imitate the gliding kite,
And seem precipitate to fall,
As if they felt the piercing ball.
The tender colts on back do lie,
Nor heed the traveler passing by.
The rocks are seen in shade to sweat,
Although the sun is radiant yet.
In fiery red the sun doth rise,
Then wades through clouds to mount the skies.
'Twill surely rain, we see it with sorrow,
'Twill rain to-day and rain to-morrow."

As the "hollow winds" are south winds, which are productive of moisture, and are likely to cause a depression in the atmospheric ocean, the barometer usually falls when they blow, and air of a cooler temperature coming from the north to fill up that depression, usually condenses the moisture, causing rain. The "soot falls down," as by the absorption of water from the overcharged atmosphere it is loosened and crumbles off.

Spiders on the alert for food, build their webs to catch flies; and as their hunger, like that of flies and fishes, becomes more intense when a part of the atmospheric pressure is removed, they are very impatient for food, and so peep out from their hiding-places. Who has not noticed spider-webs in the fields flat, and

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also at different angles, and heard the remark that when flat they denoted fair weather, and otherwise foul weather? The spider, intent only upon his food for the ensuing day, spins his web with instinct, almost reason. A fine day is always preceded after midnight with perfect calm, and at this time the spider builds his web flat. If a change of weather is in progress, this calm does not exist, and a breeze is in its place. The spider, knowing that rain-drops break his web, if flat, builds it at an angle according to the amount of wind, so the rain-drops will not strike fairly and break it. They sometimes fast, not building at all when the storm is to be very violent.

Circles around the moon, or mock suns, known as sun-dogs, show that there is a large amount of moisture in the higher atmosphere, and are always brightest upon the sides of the sun from whence the wind is blowing in the upper atmosphere. As an illustration, we reason from this phenomenon thus: It is winter, the sun-dog is on the south side of the sun, or brightest on that side. It shows south wind with moisture, which indicates warmer weather, with rain or snow. If upon the north side, cold winds with a small amount of snow.

Rainbows are formed by reflection of the sun's rays from falling drops of rain. If it rains in the morning when the sun's rays should dissipate the clouds, if a fair day, it is quite likely to rain more or less all day. From this the saying so common, —

"A rainbow in the morning,
Sailors take warning;
A rainbow at night,
Sailors take delight," —

is as a general thing correct, showing foul weather if in the morning, and a pleasant night, and perhaps for the next day, if seen at night.

"The walls are damp, the ditches smell."

In fair weather the atmosphere is usually more dense and the barometer higher, which shows the atmospheric pressure is greater; the gases which escape from foul places rise high above our organs of smell, as their specific gravity is nearly

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uniform: while before a storm the atmosphere is less dense, consequently, as the disagreeable gases are the same heft, they float within range of our organs of smell, or but little, if any, higher than our heads. Thus they show, by smell, probable storm.

"Closed is the pink-eyed pimpernel."

There are five plants which have been observed from time immemorial as indications of weather changes. They are the dandelion, trefoil, pimpernel, chickweed, and Siberian thistle.

The down of the dandelion closes for bad weather, but expands upon the return of sunshine. The trefoil is observed in Europe to have swelled stalks before rain, and contracts its leaves before showers. The pimpernel, which I suppose is the *anagallis arvensis* of Linnæus, is found in this country, and in some States grows in old fields, and among grain, where I have heard it called "devil weed." It flowers all summer, and when found in the morning with its red flowers shut, it will be a foul day; when fully open, a fair day; partially so, doubtful weather. Chickweed, which is common the world over, is an excellent weather-guide. When its flowers expand freely, no rain may be expected for some hours; if it continues open for twenty-four hours, no rain for days; half-open all the time, showery, uncertain weather; closed, long-continued rain. If the flowers of the Siberian thistle are open all night, rain the next day is probable.

As regards the effect on animal life, what the coming storms have to do with it, is not so clear; yet the weather-prognostics derived from the animal kingdom are often more to be relied upon than many people imagine. The lassitude and indefinable anxiety of nervous individuals before a thunder-storm, the shooting pains in old wounds or scars, the aching and pricking of chilblains and corns, the attacks of headache or rheumatism, when a considerable change of the weather is about to take place, entitle many sensitive persons to be called living barometers, and so with the animal kingdom. I am inclined to think that the changes in atmospheric pressure may have to do with it, as it certainly does with the appetites of fishes and insects. It is well understood that fish generally bite best before a

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storm, and it is then that fishermen are about. They bite the best, as they feel a peculiar hunger when the barometer is low, showing less pressure from our atmosphere, and that is usually before a storm.

It is the same with insects. It would seem that at such times they had extraordinary feelings of hunger. All have realized, more or less, their greediness before a storm.

"Low o'er the grass the swallow wings."

It is a well-known fact in natural history that certain insects have an exact number of vibrations of the wing to the minute, and if they fly at all it is in the same manner. When the barometer is high, the atmosphere near the surface of the earth is more dense, from the increased pressure, and such insects consequently fly as high or higher than our buildings. With less pressure, or a low barometer, they will rise but a few feet above the ground.

The swallows that feed upon these insects, which they catch upon the wing, fly at the height that their food flies, which on account of their diminutive size do not attract our attention, while the swallows readily do. So even this sign has scientific fact for its basis.

Thus I might follow out line after line of the poem, showing its agreement with well-known facts; but I should risk tiring your good nature in so doing, and as I have given you examples, will only add that the sweating of rocks, so called, being frequently supposed actual sweat, is only a deposit of dew; and when deposited from the atmosphere in the daytime, shows that there is a very large amount of water held in saturation, and a change is likely to occur, causing it to fall as rain.

Rain may be expected when the sun rises pale, or when, after setting, clouds ascend in the part of the sky from whence the wind blows. A red morning sky is usually followed by rain; a red evening sky, by fair weather. For twenty-five years the probabilities in these cases as true, have been as ten to one. This proves the old adage, —

"Evening red and morning gray,
Will help the traveler on his way;
But evening gray and morning red,
Will bring down rain upon his head," —

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was founded on fact. When the moon is pale in color, with horns blunt at first rising, the stars seeming large, dull, and pale, with no perceptible twinkle, or if encompassed with a circle, it indicates an excess of moisture in the atmosphere, and probable rain. If mists are attracted by tops of hills or mountains after clear weather, expect rain in a day or two. In dry weather, if mists ascend from wood-land or water, higher than usual in the morning, look out for immediate rain; but if such mists appear after sunset or before sunrise, it denotes fair and warmer weather the next day. If the rain commences an hour or two before sunrise, the clouds will probably be dissipated by the heat of the sun, and it will clear up before noon. If it commences an hour or two after sunrise, it will be likely to rain all day. A bright moon with sharp horns, or sharp definition if full, wind shifting north, a sky full of bright twinkling stars, small clouds at north and none at south, and perhaps appearing in heaps, denote colder weather. The same with clouds and wind shifting south, indicate warmer weather.

Whether a storm will clear off warm or cold is often a question of moment, and must be ascertained from experience and observation. From a long series of observations I would say that generally when the clouds break up so that we can catch glances of the cirrus cloud, if that is seen to move from the south or the south-west, the storm will clear off warm; if from the opposite direction, it will clear off cold. Again, if the surface winds wheel round from the south to the west, warm weather is indicated; if from the north to the west, it will be cooler. So in time of thunder-showers, if they pass to the south of us, the atmosphere will seem much cooler than if they pass to the north. Again, the waves of temperature approach regularly. The old adage, that one extreme follows another, is verified in fact; and we usually have gradually increasing cold followed by as regular an increase of temperature. This is more readily discernible in the winter season, as will be seen by every one who has a thermometer, and will take the trouble to look at it. It is during this season that we have the greatest atmospheric changes, sometimes even as great as 100° of temperature in twenty-four hours.

There is another class of signs which some believe in, that are

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merely superstition, having no foundation in fact. The Hindoos have their rain-gods, the South Sea Islanders their wind-conjurers, and the negroes of Africa their rain-doctors; and previously we had our weather-almanacs and our Herschel's weather-tables, one just as good as the other. Not many years ago that celebrated Herschel's weather-table, which Herschel never saw, was considered almost infallible, and Thomas's Almanac quite so; but all enlightened people, unless some whose age has outgrown science, discard them. For the last thirty years our storms have taken place without regard to moon's quarters. We have had 2,668 storms, divided as follows: At new moon, 660; first quarter, 664; full moon, 668; last quarter, 676. This shows very plainly that the moon has nothing to do with storms. If the generally received idea was true, what little difference there is goes directly against it. The truth is that the moon has so little, if any, influence upon the weather, that men have never found out which way it is; and I can say, without fear of contradiction, that rain and wind doctors, and Hindoo gods, have just as much to do with the weather as this weather-table, and no more.

In snow-storms the form of the flakes, if observed, will tell the probable amount of the storm. Without cuts a description of the shapes would be useless, and I therefore ask all to observe for themselves. We see the intelligent laws of God displayed in the countless myriads of snow-flakes in any snow-storm, usually all alike, and all perfect; being ice, yet falling with such fleecy lightness that it requires one foot of recently fallen snow to be equal to one inch of rain. We see different snow-storms unlike in the form of flake, yet a large majority of them will be stars of six points, but there are more than one hundred different manners of forming them. Why they have six points instead of three, or five, no one can tell. That subtile substance which we call an electric fluid sometimes tinges those beautiful snow-flakes with light, rendering them distinct in the night, and shedding a faint, though certain, light around. Observation has led me to believe that electricity is in fact a part and parcel of all clouds, being necessary to their existence, and perhaps in a great degree aiding or preventing their formation. If so we must expect that snow-clouds also share, and those beautiful tinted clouds of night,

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sometimes visible, appearing as part of the aurora borealis, may be, and I think many times are, the nucleus of coming storms. That the aurora is in some way connected with our atmosphere, no one now doubts. That the same electricity which electrifies our storms produces it, is equally certain ; then why may it not be instrumental in their production? You will seldom see a brilliant display of the aurora without a storm soon following it.

Could we but know a little more we could easily predict storms truthfully ; but we must content ourselves with the intellect God has given us, and praise him that we are enabled to turn the lightning stroke from our dwellings, and harness the unknown principle of electricity, causing it to convey our words to the farthest points of earth, without delay. Yet we would fain know many things of our atmosphere, its currents and its aqueous meteors, which time will unfold. Should the next century bring with it as much science as the last, the farmer will not be at a loss to-day about the weather of to-morrow. Storms of intense thunder and lightning, with hail, will be avoided altogether, and many present wonders of the atmosphere will be understood. And the individual man will be gradually prepared for the nobler contemplation of the works of God, of whose greatness and goodness we can form no adequate conception.

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ANALYSES, EXPERIMENTS, AND INTERESTING FACTS.

THE statutes authorize the Board of Agriculture to cause to be analyzed "samples of fertilizers and such other articles as the interests of agriculture demand," and for this purpose the Board may expend a sum of money equal to the amount received by the State for licenses to sell fertilizers.

Until this year, but a very small sum has been expended for this purpose, — scarcely one hundred dollars during the ten years the Board has existed. The following articles have been examined chemically, at a cost of less than three hundred dollars, while no money has been paid out for experimental work. The law requiring the licensing of the sale of trees, shrubs, and other articles produced out of the State, and offered by canvassers, gives the Board authority to expend the amount received in means of detecting spurious seeds, trees not true to name, and an investigation of patent rights of farm implements offered for sale in the State. No measures have yet been taken to accomplish this object, but the Board have decided to initiate steps in that direction the coming year.

The trustees of the College of Agriculture are required to cause articles under the heads above named to be analyzed, reports of which are to be made to the Secretary of the Board for publication. A small portion of the examinations reported have been made through the agency of the professor of chemistry in the college, a larger number through the efforts of the superintendent of the college farm, and still more have been obtained by the Secretary, from various reliable sources, —

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Prof. Collier of the department of agriculture contributing with great liberality a large number of examinations, while Prof. Johnson of the Connecticut Experimental Station has furnished several very valuable contributions.

ANALYSES.

ORCHILLA OR CARIBBEAN GUANO.

Water	2.91 per cent.
Carbonic acid	17.04 " "
Equal to carbonate of lime	38.72 " "
Nitrogen	.26 " "
Equal to ammonia	.32 " "
Bone phosphate	18.69 " "
Equal to available phosphoric acid	8.56 " "
Insoluble phosphoric acid	13.34 " "

The money value of this guano is very nearly as follows: —

Nitrogen, 5.2 pounds at 20 cents	$1.04
Phosphoric acid, 438 pounds at 6 cents	25.28
	$26.32

If we give the available phosphoric acid the value of 12 cents instead of 6 cents, as is sometimes done, it will add $10.26 more to the ton, or $36.54.

Now as this is sold at $25 per ton, it will be seen that according to the analysis, it is, at the lowest estimate of the phosphoric acid, a very cheap article. The nitrogen is in very small quantity; the potash, none; but the phosphoric acid abundant. For much of our rocky hill-land, which has been long cropped or pastured, this element having been removed, the Orchilla will prove serviceable if the analysis should show a uniformity of the above value. It is said to run somewhat uneven, unless very thoroughly mixed, some grading up to $40, and others falling considerably below the medium here obtained.

It is not much known in the State, being sold only at Portsmouth. As it is a natural product, it can be sold without license.

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KERWIN'S GROUND BONE, MANCHESTER.

A sample of this was taken by the Secretary, without the knowledge of the manufacturers, and submitted to an analysis, with the following result: —

Water	8.69 per cent.
Nitrogen	3.91 " "
Equal to ammonia	4.75 " "
Bone phosphate	55.49 " "
Equal to phosphoric acid	25.42 " "

The cash value of this article may be seen in the accompanying statement: —

Nitrogen, 78.2 pounds at 20 cents	$15.64
Phosphoric acid, 508.4 pounds at 6 cents	30.50
	$46.14

A comparison has been made with several other manufactures, and this takes the lead, Bowker's of Boston, and Belknap's of Portland, ranking but little below. Of twenty samples, these are the first, second, and third in quality.

We think Messrs. Kerwin and Son are selling at forty dollars, — a very cheap rate for first-class bone meal, — made without steaming and burning the nitrogenous matter out of the bones.

CONCENTRATED PRIVY GUANO.

This is a new claimant, not yet known in our State. Prof. Johnson of New Haven has found it to contain an excessive per cent of nitrogen, in several forms, a fair amount of phosphoric acid, sulphuric acid, soda, and lime, and a large percentage of potash.

The nitrogen, 292 pounds per ton	$72.42
Potash, 498 pounds per ton	37.35
Phosphoric acid, 155.2 pounds per ton	19.40
	$129.17

Commercial price, sixty-five dollars. This is altogether too good to last.

Prof. Johnson says of this article: "This 'privy guano' has an unmistakable privy odor, but, unlike night-soil, it is almost entirely soluble in water, and, unlike both night-soil and urine, it

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consists mainly of nitrates and phosphates of potash, ammonia, and soda. It is not manufactured from night-soil, although it is flavored with this last-named substance. Its commercial value is almost double its cost, a fact that would be very welcome to the consumers of fertilizers if it could remain a fact. But a 'privy guano,' of this composition, cannot long be afforded for much less than one hundred and thirty dollars per ton; and the extraordinary value of the two samples that thus early have found their way to the station, should put purchasers on their guard against a sudden and great decline in its composition and value. Any parties who have laid in a supply would do well to have samples analyzed before waiting for a crop, and should remember that the first fertilizers bulletined by the station (in August, 1877) were Pollard's 'Composition for Grass,' of which the cost was $32 and the estimated value $1.03, and Pollard's 'Composition for Vegetables,' cost $32, estimated value $0.99."

MITCHELL'S SUPERPHOSPHATE.

Moisture	32.55 per cent.
Soluble phosphoric acid	7.25 " "
Insoluble	.50 " "
Nitrogen	1.86 " "
Or ammonia	2.27 " "

The value as per analysis is not over twenty-five dollars per ton. Its sale was stopped in our State by order of the Board, except on condition that license be purchased and the price put down in conformity with its value.

GOODS FROM H. J. BAKER AND CO.'S, NEW YORK.

Prof. Johnson has examined several of the Forrester's fertilizers, their values and costs, as follows: —

Onion fertilizer, estimated value	$54.68, price	$49.00
Potato " " "	51.50, "	49 00
Corn " " "	51 10, "	49.00
Cabbage " " "	48.69, "	51.00
Turnip " " "	54.01, "	53.50
Oat " " "	49.80, "	49 00
Castor pomace, " "	21.45, "	20 00
Pure ground bone, " "	45.21, "	32 00

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MUCK AND PEAT.

Samples sent by Orland Fogg, Esq., of Harrisville: —

	Muck.	Peat.
Water	8.67	6.74
Organic and volatile matter	28.87	84.95
Ash	62.46	8.31
	100.00	100.00
Total phosphoric acid	.38	.12
Potassium oxide	.23	.10
Nitrogen	1.01	1.54
Equal to potential ammonia	1.22	1.84

This makes these articles nearly as valuable as ordinary manure from barn-yards, especially for soils that are wanting in humus.

Prof. Johnson gives analyses of thirteen samples in a recent number of his "Bulletin," which we copy in full.

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ANALYSES OF SWAMP-MUCK.

Contents of Fresh or Undried Muck.	SAMPLES.												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Water	80.68	62.25	42.19	38.04	88.51	32.08	77.23	70.90	67.26	73.81	87.13	81.36	79.73
Organic (vegetable) and volatile matter	15.93	26.33	12.80	55.72	10.40	53 82	21.83	7.55	19.75	23.39	11.55	6.94	16.74
Ash, including sand and soil	3.39	11.42	45.01	6.24	1.09	14.10	0.94	21.55	12.99	2.80	1.32	11.70	3.53
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Contents of the Ash.													
Silica and substances insoluble in acid	2.19	7.66	36.08	3.34	0.42	9.83	0.42	.....	7.87	1.63	0.48	10.78	2.63
Oxide of iron, alumina, and phosphoric acid	0.35	0.88	6.32	0.70	0.13	.....	0.31	1.61	4.55	0.34	0.20	0.57	0.27
Lime	0.44	1.78	0.69	1.32	0.23	1.28	0.09	0.06	0.11	0.38	0.35	0.09	0.42
Other matter not separately determined	0.41	1.10	1.92	0.88	0.31	2.99	0.12	.....	0.46	0.45	0.29	0.26	0.21
Nitrogen (in organic matter)	0.41	0.33	0.33	1.36	0.25	0.91	0.24	0.26	0.41	0.60	0.31	0.18	0.44
Poisonous matter — salts soluble in water	none	none	none	none	none	none	none	trace	much	none	none	none	none
Contents of the Dry (Water Free) Mucks.													
Organic and volatile matter	82.44	69.48	22.14	89.93	90.51	79.24	95.87	25.95	60.32	89.31	89.74	37.23	82.58
Ash	17.56	30.52	77.86	10.07	9.49	20.76	4.13	74.05	39.68	10.69	10.26	62.77	17.41
Lime	2.27	4.71	1.19	2.13	2.00	1.88	0.39	0.26	0.33	1.45	2.72	0.48	2.07
Nitrogen	2.12	0.87	0.57	2.19	2.18	1.34	1.05	0.89	1.25	2.29	2.40	0.96	2.17
Contents of the Organic Matter.													
Nitrogen	2.57	1.25	2.58	2.44	2.40	1.69	1.10	3.44	2.08	2.57	2.68	2.59	2.63

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The different samples of muck, as numbered in the table, are as follows : —

1. Upper stratum.
2. Lower stratum.
3. From a lower level than No. 2.
4. Cured muck.
5. Fresh muck.
6. Muck well cured.
7. Fibrous muck, from above No. 8.
8. Bottom muck, from below No. 7.
9. Mucky soil of drained meadow.
10. Swamp muck.
11. Swamp muck, upper layer.
12. Swamp muck, lower layer.
13. Rich muck.

INDIAN CORN.

These analyses were made by Prof. Collier, chemist of the department of agriculture at Washington.

Taking the samples in the order in which they stand in the table, the producers are as follows : —

1. Unknown.
2. J. O. Adams, Secretary, at Boscawen on sandy loam.
3. On same lot and soil.
4. Mr. Rockwood of Brookline.
5. Mr. Putnam of Hooksett.
6. S. F. Wadleigh of Meredith.
7. Moses Humphrey, Chairman, of Concord, on sandy loam.
8. J. O. Adams, at Boscawen.
9. Ward Parker of Merrimack, on sandy loam.
10. S. F. Wadleigh of Meredith, on hard-wood soil.
11. Mr. Lakin of Bennington.

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ANALYSES OF INDIAN CORN.

Air Dried.	1. Small Eight-rowed. White.	2. Adams. Yellow.	3. Canada. Yellow.	4. Small Twelve-rowed. Yellow.	5. State Fair Premium. Yellow.	6. Large Premium. Yellow.	7. Board of Agriculture. Yellow.	8. King Philip.	9. Miscegenation, or Speckled.	10. Pitch Knot.	11. Tom Thumb. Pop. Yellow.
Water	11.05	8.61	8.27	11.48	10.19	10.00	11.09	10.23	9.92	11.24	9.05
Oils	4.80	4 83	5.60	6 03	5.29	5.52	4.68	7.05	5.33	5.26	5 89
Sugars	1.94	2.25	2.52	2.04	2.87	2.35	1.69	2.35	1.95	2.72	2 22
Albumen, insoluble in alcohol	5.79	4.01	5.16	4.84	5.56	5.25	4.67	4.31	5.26	5 39	4 80
Zeine, soluble in alcohol	7.86	6.49	6.20	5.66	5.26	6.11	6.88	7.77	6.46	5.81	7.80
Gum	2.74	1.50	1.68	1.80	1.37	1.80	2.14	3.18	2.16	2.20	3.00
Cellulose	1.30	1.19	1.26	1 09	1.06	1.09	.82	1.01	1.05	1.04	1.33
Ash	1.57	1.57	1.72	1.34	1.78	1.46	1.31	1.84	1.63	1.52	1.60
Starch, by difference	62.95	69.65	67.59	65.72	66.62	66.42	66.72	62.26	66.24	64 82	64 31
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Water Free.											
Oils	5.40	5.28	6.11	6.81	5.89	6.14	5.26	7.86	5.92	5.92	6.47
Sugars	2.18	2.46	2.74	2.31	3.19	2.61	1.90	2.61	2.17	3.02	2.44
Albumen, insoluble in alcohol	6.51	4.38	5.60	5.47	6.19	5.84	5.25	4.81	5.84	6.07	5.28
Zeine, soluble in alcohol	8.84	7.10	6.76	6.40	5.86	6.79	7.74	8.66	7.17	6.55	8 57
Gum	3.08	1.64	1.83	2.03	1.52	2.00	2.40	3.55	2.40	2.49	3.30
Cellulose	1.46	1.30	1.37	1.23	1.18	1.21	.90	1.13	1.17	1.17	1.46
Ash	1.76	1.72	1.87	1.51	1.98	1.62	1.47	2.04	1.81	1.71	1.76
Starch, by difference	70.77	76.12	73.72	74.24	74.19	73.79	75.08	69.34	73.52	73.07	70.72
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

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APPLES.

Examined at the Connecticut Experimental Station. Of the ash of apples there was of —

Potash	53.42	per	cent.
Soda	.83	"	"
Lime	3.78	"	"
Magnesia	3.54	"	"
Ferric oxide	1.07	"	"
Sulphuric acid	2.96	"	"
Phosphoric acid	4.27	"	"
Chlorine	.46	"	"
Carbonic acid	20 69	"	"
Water	6.53	"	"
Insoluble matter	1.19	"	"

GRASSES.

Collected mostly by William H. Hills, Esq., of Plaistow, member of the Board from Rockingham County.

SOLUBLE AND INSOLUBLE NITROGEN COMPOUNDS IN GRASSES WATER FREE.

Grasses.	Total Nitrogen.	Soluble Nitrogen.	Per cent Nitrogen Soluble.	Insoluble Nitrogen.	Per cent Insoluble Nitrogen.	Insoluble Nitrogen computed to Albuminoids.
Muhlenbergia	2.14	.80	37.38	1.34	62.62	8.40
Triticum repens	1.84	.45	24.45	1.39	75.55	8.69
Festuca pratensis	1.72	.77	44.77	.95	55.23	5.93
Festuca ovina	.95	.....	.....	.....	.....	.....
Plantago lanceolata	1.70	.61	35.88	1.09	64.12	6.81
Glyceria nervata	1.33	.45	33.83	.88	66.17	5 50
Dactylis glomerata	1.34	.42	31.34	.92	68.66	5.75
Anthoxanthum odoratum	1.37	.52	37.96	.85	62.04	5.31
Bromus secalinus	1.23	.57	46.35	.66	53.65	4.12
Poa pratensis	1.19	.37	31.09	.82	68.91	7.35
Poa compressa	1.00	.33	33.00	.67	67.00	4.18
Danthonia spicata	.93	.29	31.18	.64	68.82	4.00

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ANALYSES OF GRASSES.

AIR DRIED.	Water.	Oil and Wax.	Sugars.	Resins.	Gums.	Cellulose.	Starch. Isomers.	Alkali. Extract.	Albumen.	Ash.
Muhlenbergia (Knot grass)	8.56	3.41	12.90	1.53	2.30	20.82	21.93	10.50	12.25	5.80
Triticum repens (Couch grass)	7.00	3.27	9.76	3.47	2.90	18.05	20.99	15.21	10.68	8.67
Festuca pratensis (Fescue)	7.37	3.02	9.08	1.60	2.38	22.32	22.50	12.84	9.85	8.40
Festuca ovina	8.82	3.88	9.43	4.88	1.64	.....	60.81	.....	5.95	4.59
Plantago lanceolata (Plantain)	7.85	4.11	12.70	3.11	5.22	20.24	13.79	16.28	9.80	6.90
Glyceria nervata	7.36	2.70	10.50	2.91	1.64	20.35	21.70	18.84	7.70	6.30
Dactylis glomerata (Orchard grass)	6.28	3.27	9.16	4.98	2.74	23.35	22.19	12.24	7.88	7.91
Anthoxanthum odoratum (Sweet vernal)	8.08	3.13	7.92	1.74	2.40	23.71	23.45	13.95	7.87	7.75
Bromus secalinus (Chess)	9.22	3.70	9.47	1.77	1.90	21.60	20.88	17.98	7.00	6.46
Poa pratensis (Kentucky Blue grass)	8.97	4.51	9.03	2.70	1.66	20.45	20.90	19.97	6.83	4.98
Poa compressa (English Blue grass)	7.93	2.61	9 90	1.56	11.48	19.20	23.45	14.20	5.77	3.90
Danthonia spicata	3.29	3.67	7.20	3.01	1.74	28.15	27.70	15.40	5.60	4.24
WATER FREE.										
Muhlenbergia	.....	3.73	14.10	1.68	2.52	22.76	23.97	11.51	13.39	6.34
Triticum repens	.....	3.52	10.50	3.73	3.12	19.40	22.57	16.35	11.48	9.52
Festuca pratensis	.....	3.29	9.88	1.74	2.59	24.22	24.42	13.98	10.73	9.15
Festuca ovina	.....	4.25	10.27	5.36	1.80	.....	66.76	.....	6.53	5.03
Plantago lanceolata	.....	4.46	13.73	3.37	5 65	21.97	14.99	17.68	10.68	7.47
Glyceria nervata	.....	2.92	11.34	3.14	1.77	21.96	23.42	20.33	8.32	9.80
Dactylis glomerata	.....	3.47	9.80	5.32	2.93	24.84	23.73	13.06	8.41	8.44
Anthoxanthum odoratum	.....	3.41	8.63	1.89	2.61	25.72	25.56	15.19	8.56	8.44
Bromus secalinus	.....	4.07	10.42	1.95	2.10	22 86	22.99	19.79	7.71	7.11
Poa pratensis	.....	4.96	9.93	2.97	1.82	22.49	22.89	21.96	7.51	5.47
Poa compressa	.....	2.84	10.78	1.70	12.50	20.82	25.46	15.36	6.29	4 25
Danthonia spicata *	.....	3.79	7.45	3.11	1.79	29.10	28.63	15.96	5.79	4.38

* Known in this State as "White top."

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The following analyses were made by Prof. Collier, of samples sent from the college farm at Hanover by Mr. Sanborn, superintendent of the farm: —

PROXIMATE ANALYSES OF HAY.

Contents.	Number of Plats.		
	1	2	3
Moisture	7.79	7.13	7.45
Crude Ash	5.80	5.19	4.66
Oil and Chlorophyl, Ether extract	3.01	3.06	2.96
Wax, Ether extract	1.30	1.49	1.26
Resin and Color, Alcohol extract	2.83	2.38	0.47
Sugar and Soluble Nitrogenous Substance, Alcohol extract	7.84	5.21	5.81
Gum, Water extract	3.32	3.90	3.14
Crude Fiber	20.10	24.18	31.21
Starch Isomers, Acid extract	22.02	29.91	35.83
Alkali Extract	16.86	9.86	.....
Albuminoids, Insoluble Nitrogen × 6.25	9.13	7.69	7.82
	100.00	100.00	100.00
Soluble Nitrogen	0.40	0.28	0.13
Soluble Nitrogen × 6.25	2.50	1.75	0.81
Total Nitrogen × 6.25	11.63	9.44	8.63

Plat 1, cut ten days before blooming.
Plat 2, cut when in full bloom.
Plat 3, cut when seed was forming.

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ANALYSES OF GRASSES.

Contents.	Number of Plats.					
	1	2	3	1	2	3
Moisture	7.79	7.13	7.45	.....	.....	.....
Ash	5.80	5.19	4.66	6.29	5.59	5.04
Fat	4.31	4.55	4.22	4.67	4.90	4.56
Nitrogen, Free extract	50.37	49.51	43.83	54.63	53.31	47.36
Crude Fiber	20.10	24.18	31.21	21.80	26.04	33.72
Albuminoids	11.63	9.44	8.63	12.61	10.16	9.32
	100.00	100.00	100.00	100.00	100.00	100.00
Per cent of Total Soluble Nitrogen	21.50	18.50	9.40	.....	.....	.....
Ratio of Fats to Albuminoids and Carbo-hydrates.						
Fats	1.00	1.00	1.00	.....	.....	.....
Albuminoids	2.70	2.10	2.00	.....	.....	.....
Carbo-hydrates	11.70	10.70	10.40	.....	....	.....

An analysis of plats 2 and 3 from second series gives the following result: —

Contents.	Number of Plats.			
	2	3	2 Water Free.	3 Water Free.
Water	11.84	10.83	.....	.....
Chlorophyl, etc.	2.79	2.77	3.17	3.11
Wax	2.01	1.83	2.28	2.05
Sugars	7.59	6.81	8.61	7.64
Gum	4.45	5.60	5.05	6.28
Cellulose	22.22	22.91	25.20	25.69
Amylaceous Cellulose	23.02	25.79	26.10	28.92
Alkali Extract (difference)	11.28	10.33	12.79	11.58
Albuminoids	7.38	6.81	8.37	7.64
Nitrogenous Substances not Albuminoids	3.05	1.95	3.46	2.19
Ash	4.37	4.37	4.97	4.90
	100.00	100.00	100.00	100.00

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Prof. Collier makes the following statement in regard to the matter: —

"I send you results of the proximate analyses of the three samples of grasses received from you. Nearly every constituent was determined in duplicate, and when any marked difference was obtained in analysis a third determination has been made, so you may rely upon the results. A few words in explanation are necessary. Every constituent given was estimated, and there is really nothing given 'by difference,' as perhaps might seem from the results.

"The total nitrogen was determined in each, and also the nitrogen remaining in a fresh sample of grass after it had been dissolved out by alcohol. This insoluble nitrogen was called albuminoids, after multiplying by 6 25. The difference between total nitrogen and albuminoid nitrogen was also multiplied by 6.25, and called soluble nitrogenous substance. Now this albumen was to be deducted, you see, from the alkali extract, and so the amount given as alkali extract is not really all that the alkaline solution would remove, but only the new nitrogenous portion. And as a matter of fact in No. 2, the alkaline extract fell short .61 of being enough to account for the albumen, but, as we shall see, this is about as it should be.

"Now as to this soluble nitrogenous compound, no one, I think, knows its composition even, and much less its nutritive value. I do hope your feeding experiments may throw light upon the question. It is a matter of very great importance, for in many of the grasses we have this year analyzed we find this soluble nitrogenous substance, or the soluble nitrogen, in much larger proportion to the insoluble than in either of yours. The starch isomers is what, in report for 1878, I called amylaceous cellulose. You will by reference to that report see my reasons for so calling it, and how it is obtained. Starch it certainly is not, nor is it cellulose, but it deposits itself as starch and diluted sulphuric acid, in Feblings' solution."

SUGAR BEET.

Johnson gives the following: —

Imperial sugar beet	7.83	per cent	sugar.
Lane's Imperial	6.50	" "	"
White Silesian	9 53	" "	"
White French	11.40	" "	"

EXPERIMENTS.

POPPLEIN'S SILICATED PHOSPHATE.

J. W. Sanborn, at the college farm, gives the following report of results from the use of this fertilizer: —

"Baltimore phosphate gave seventy-seven bushels of ears of sound corn

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per acre, and twenty-seven bushels soft corn. This was a fair yield, and might be considered as confirmatory of the manufacturers' claims; but *all my other plats*, very strangely contrary to last year's results, show me that ammonia has done no good for my corn this year. This is no accidental result, but presents an important and interesting question in agriculture; namely, the influence of seasons on nitrogen supply from natural sources to vegetation, and the laws relating thereto.

"The other strictly mineral plats gave better results than the Popplein. Thus you see the object of the sample you sent is not in any way forwarded; for my corn, on this alluvial clay, has, this year, got from natural sources its needed supply of nitrogen. Hence the makers' claim in regard to their departure in fertilizer manufacture, so far as this experiment is concerned, is in no wise substantiated or denied. Tried in other seasons, when the peculiar influences that present to plants the means of gathering their own nitrogen from natural sources are wanting, or in play to a minimum extent, so far as this experiment is concerned, it might substantiate the makers' claim. I do not expect such result. I may add that a nothing plat gave 43 bushels sound, and 30 bushels of soft corn. The amount used was sufficient to give the phosphoric acid and potash for fifty bushels of corn and stover, or same as in my other mineral plats. If you have the composition of the material you can figure it out. I applied sufficient to give 31 pounds of phosphoric acid and 71 of potash. As the material was not made in that proportion, it will be found that there was an excess of one material used. The stover on the nothing plat was 37 pounds; Popplein, 56.60 pounds. I did not think until I had got nearly done that you might want to publish the result."

SPECIAL FERTILIZERS ON POTATOES.

Mr. J. F. Emery, of Wilmot, reports the results of his careful experiments with special fertilizers applied to potatoes, as follows: —

"Planted June 10, on sodland, rows three feet apart, hills two and a half feet, and hoed but once; variety of potatoes, White Brooks. The soil a sandy loam with clay subsoil. The condition of the land was very poor, not cutting over five hundred pounds of hay to the acre. I chose this to better test the strength of the fertilizers rather than land of better tilth. I obtained an experimental set last spring in order to find what my land needed to produce the different kinds of crops generally grown on our farms. It consisted of four bags of fifty pounds each, costing five dollars; bag A, fifty pounds complete manure, for all crops and all soils, containing the main ingredients in about the same proportion as stable manure, but in far more soluble and concentrated form, it being in condition for immediate wants of the rootlets of plants; bag B, same as bag A, with nitrogen omitted; bag C, same as bag A, with phosphoric acid omitted; bag D, same as bag A, with potash omitted. The result on potatoes you will see in my tabular state-

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ment, showing the importance of potash and phosphoric acid; the potash to make a healthy tuber, the phosphoric acid to aid in both vine and tuber. In the application of the manures they were applied in the hill, being thoroughly incorporated with the soil, this being done with the hoe; the barn manure being treated the same as the artificial manures. Our soils, deprived of potash by many years of cultivation, can be replenished with this ingredient, if we will but use it. There is no lack of materials of the very kind we need, but we ignore them. We have not yet been educated up to that point. But I hope we are mending. We have scornfully treated all book-farmers. But I am now ready to admit that these men have been able to teach us something, and we have fallen into their ways of study and experimenting. That is a good deal. Now we want to have faith in an improved agriculture, and to make our faith apparent by our works. Our present practice is unprofitable, if not ruinous. We must mend it. There are many ways in which it can be done. We can treble our crops, as shown in our experiment, by the use of fertilizers compounded by men who have spent a series of years in experimenting in getting them available as food for plants in a concentrated form. An increase of any crop means more meat, butter, cheese, and wool, and increases the sales of all commodities grown on our farms, which will react favorably upon our farms. More meat, butter, cheese, and wool; more animals; more of these, more manure; more grass, roots, corn, and wheat, should be the motto of every farmer. But where, they say, is the starting-point to accomplish all this? I say again, it is in the more liberal use of artificial manures. After we have carefully husbanded all our natural supplies, let us waste nothing; and then procure all we can, besides."

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EXPERIMENTS WITH SPECIAL FERTILIZERS ON POTATOES.

No. of Row.	Pounds per row of 40 hills.	Bushels per acre.	Cost of the Fertilizer per acre.	Amount of Fertilizer per acre.	Cost per bushel per acre.	Increase of bushels per acre.	Cost of increase per bushel.	Kind of Fertilizer Used in the Experiment.	Condition of the Crop when Harvested.
1	121	305 35-60	$12.50	.....	4 1-9 cents.	217 25-60	5⅜ cents.	One large shovelful of manure from the barn-cellar.....	More or less, say 4 per cent, of diseased tubers, good size, and smooth.
2	112	280 50-60	5.00	20 bushels.	1⅞ cents.	192 40-60	2⅜ cents.	Two parts leached ashes and one part hen-manure, one quart to the hill.....	Two per cent diseased ones, size and condition same as with manure.
3	51	129 45-60	2.50	20 bushels.	2 cents.	41 50-60	6 cents.	Leached ashes alone, one quart to the hill.....	Small, but smooth and sound.
4	36	90 45-60	1.50	1 cask.	1⅞ cents.	2 35-60	66 cents.	Air-slacked lime, one pint to the hill.....	Small; the dirt sticking bad, and worm-eaten.
5	36	90 45-60	1.50	1 cask.	1⅞ cents.	2 35-60	66 cents.	Plaster, large spoonful to the hill.....	Small, but sound; enough in the hill; no rot; some worm-eaten.
6	35	88 10-60	.....	.....	.....	.....	.....	Nothing put in the hill.....	No rot, but rough and worm-eaten; dirt sticking to them bad, and small.
7	64	161 20-60	12.50	500 pounds.	7⅞ cents.	73 10-60	17 cents.	Experiment set — potash being omitted.....	More diseased ones than on the rest of the piece; one-eighth acre smooth and fair size.
8	89	224 20-60	12.50	500 pounds.	5½ cents.	136 10-60	9 1-5 cents.	Experiment set — nitrogen being omitted.....	No rot; medium size; smooth and free from attack of worms.
9	40	100 50-60	12.50	500 pounds.	12½ cents.	12 40-60	1 dollar.	Experiment set — phosphoric acid being omitted.....	No rot; no worm-eaten ones found, but very small.
10	120	302 30-60	12.50	500 pounds.	4 1-7 cents.	214 20-60	5½ cents.	Experiment set — complete manure.....	No rot; no worm-eaten ones; fair size, and smooth.
11	94	237	12.50	500 pounds.	3¼ cents.	148 50-60	6 cents.	Mapes's potash bone phosphate	No rot or worm-eaten, but too many small ones.
12	107	269 50-60	12.50	500 pounds.	4¾ cents.	181 30-60	6⅞ cents.	Mapes's potato manure.....	No rot or worm-eaten; found a large number in the hill, but too small.

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13	110	277 10-60	12.50	500 pounds.	4½ cents.	189	6¾ cents.	Stockbridge's potato manure	No rot; no worm-eaten ones found; more merchantable potatoes than in any row in the experiment.
14	35	88 10-60	.....	.....	.....	.....	.....	Nothing put in the hill.....	No rot, but the same as in row No. 6 as to size and condition.
15	65	163 35-60	12.50	500 pounds.	7⅝ cents.	75 25-60	16⅔ cents.	Bradley's superphosphate of lime.....	No rot, but small; some worm-eaten; about the same as in row No. 7, the rot excepted.

* Per acre.

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CHEMICALS ON CORN AND POTATOES.

Fred C. Parker, of Lempster, a recent graduate of the College of Agriculture, reports the result of his experiments as follows: —

"I experimented with a few chemicals last season, and forward a report of them to you for publication in the 'Bulletin,' hoping that they may be of use to some, and stimulate others in the same direction, the coming season. I used sulphate of potash, bone-black, dried blood, 'Baltimore sand' or Popplein's silicated phosphate, and Coe's superphosphate. The experiment with Baltimore material was not as complete as I wished, as I tried it only on corn, grass, and potatoes. While it did not make so good corn as hog manure or the phosphates, yet it was fair corn. There was a marked difference in the second crop of grass where this was used. Shall experiment more fully next season. Below are the experiments on corn with chemicals. My plats contained one square rod and twenty-five hills: —

No. of Plat.	Hills Missing.	Kind of Fertilizer.	Pounds of Poor Corn.	Pounds of Good Corn.
1	2	Bone-black, 2½ pounds	3¾	14½
2	2	Bone-black, 1½ pounds, and sulphate of potash, 1 pound	5½	14½
3	.	Bone-black, 1¼ pounds, and dried blood, 1¼ pounds	5	17½
4	.	Bone-black, 1¾ pounds, and dried blood, ¾ pound	3¾	16½
5	.	Nothing	6	4¼
6	.	Dried blood, 1½ pounds, and sulphate of potash, 1 pound	6¾	3¾
7	1	Combination,* 2½ pounds	4½	15¼
8	1	Coe's superphosphate, 2½ pounds	4	9¼

* The three were combined in the following proportions; namely, 15 pounds of bone-black, 12 pounds of dried blood, and 7½ pounds of sulphate of potash.

"The above experiments seem to prove the general law, that phosphoric acid is *the one thing needful* for a good growth of corn

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"The experiments on potatoes were on rows three rods long, and resulted as follows: —

No. of Row.	Kind of Fertilizer.	Pounds of Potatoes.
1	Baltimore phosphate	52¾
2	Baltimore phosphate	48¾
3	Nothing	46
4	Ashes and salt	40¾
5	Baltimore phosphate and ashes	58
6	Ashes	52
7	Ashes	46¼
8	Combination used for corn	47
9	One part potash and two parts bone-black	41¼
10	Nothing	32⅜
11	Two parts potash and one part bone-black	38¾
12	Potash alone, on different land	33¼

"I notice in nearly all the experiments of others that they use the chlorate of potash instead of sulphate, and the sulphate of ammonia instead of dried blood, to obtain their potash and nitrogen. I conclude they do this because more per cent of the potash and nitrogen is contained in a pound. I hope there will be more experiments in the future than there has been in the past. It is just what is needed to build up and establish truly an agricultural science, for science is classified knowledge, and all the facts — true facts — we can obtain from any source, will materially aid in bringing about this desired end."

DAIRY EXPERIMENTS.

Mr. D. G. Roberts, formerly of the Maplehurst farm, Pittsfield, Mass., makes the following statement: —

"As reports of remarkable yields of cows seem to be the fashion just now, I give you the yield of the Swiss cow 'Bessie' since she has come under my charge. The most of the records of the remarkable yields published are of but little real value, as they are too incomplete. It is the every-day record for the whole year, and year after year, that tells the story, and makes a record valuable.

"This cow was bought to test a certain idea of mine, and we have been very particular in testing her and keeping her records.

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DAIRY EXPERIMENTS.

Month of Year.	Age of the Cow. Years.	Weight on First Day of the Month.	Days in Milk.	Daily Average in Quarts.	Total Number of Quarts for the Month.	Pounds of Butter Made.	Pounds of Milk to make a Pound of Butter.	Amount of Sales.	Feed of Cow.
1877.									
November.	5	1065	30	27.86	836	40	20.90	$16.00	Rowen hay, cabbages, and meal and bran, one-half each, 4 quarts per day.
December.	....	1090	31	27.10	840	40	21.00	16.00	Rowen hay, cabbages, turnips, and grain feed same as in November.
Totals....	....	.....	.....	.....	1676	80	.....	$32.00	
1878.									
January....	....	1190	31	29.42	912	47	19.40	$23.50	Rowen hay, corn-fodder, roots, and 6 quarts of meal and bran per day.
February...	....	1170	28	30.00	841	54	15.57	27.00	Hay, fodder, and roots, as in January, and 8 quarts of meal per day.
March.....	6	1115	31	26.00	806	40	20.00	20.00	Early-cut hay, corn fodder, straw, roots, and 4 quarts of meal and bran per day.
April	....	1205	30	24.83	745	32	23.28	12.80	Same as in March.
May.....	....	1150	31	25.80	800	35	22.86	8.75	Same as in March until turned to grass. Then grass only.
June.....	....	1190	30	24.00	720	32	22.50	8.00	Grass only.
July.....	....	1244	31	14.77	458	16	28.62	3.20	Grass only.
August*...	....	1275	31	16.77	520	30	17.33	9.00	Grass, green oats, corn-fodder.
September.	...	1115	30	28.16	845	47	18.00	18.80	Grass, fodder-corn, and 2 quarts of meal and bran per day.
October....	....	1135	31	28.80	893	55	16 23	22.00	Grass, fodder corn, root-tops, and 3 quarts of meal and bran per day.
November.	....	1160	30	28 13	844	59	16.88	23.60	Rowen hay, fodder-corn, root-tops, cabbages, and 4 quarts of meal per day.
December..	....	1200	31	27.35	848	55	15.41	22.00	Rowen hay, corn-fodder, cabbages, roots, and 4 quarts of meal per day.
Totals....	....	.....	365	.....	9232	502	18.72‖	$198.65	

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1879.									
January....	6	1240	31	32.22	1000	66	15.15	$19.80	Rowen hay, corn-fodder, roots, and 6 quarts of meal per day.
February...	....	1225	28	30.35	850	65	13.00	19.50	Rowen hay, corn-fodder, sugar-beets, and 8 quarts of meal per day.
March.....	7	1240	31	27.41	850	56	15.17	16.80	Early-cut hay (orchard-grass and clover), corn-fodder, straw, roots, and 4 quarts of meal and bran per day.
April.....	....	1215	30	25.66	770	46½	16.69	13.95	Same feed as in March.
May.....	....	1185	31	29.51	915	67¾	13.48	16.93	Same feed as in March until turned to grass, then grass, and 4 quarts of meal and bran per day.
June.....	....	1140	30	32.13	964	66½	14.50	16.62	Grass and 2 quarts of meal per day.
July.....	....	1235	31	24.35	755	51	14.33	12.75	Same feed as in June.
August....	....	1280	20	8.10	162	10	16.00	2.50	Grass only.
September†	....	1300	§	§	§	§	§	§	Grass only.
October ‡..	....	1400	18	33.88	610	35¼	17.80	12.34	Grass, fodder-corn, root-tops, and 2 quarts of meal per day.
November.	....	1350	30	39.83	1195	74¾	16.00	26.17	Early-cut hay (common English), cabbages, and 4 quarts of meal and bran per day.
December.	....	.....	31	39.48	1224	72	17 00	25.20	Same as in November, with 6 quarts of meal per day.
Totals....	....	.....	.....	.....	9295	610¾	15.13‖	$182.56	

* Dropped calf Aug. 10. † Went dry 55 days, or 110 milkings. ‡ Dropped calf Oct. 14. § None. ‖ Average.

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"It will be noticed that there was considerable variation in the richness of her milk during the first year, which perhaps needs some explanation. From Jan. 1 to March 1, 1878, her feed was changed and increased to see how well she would do for the month of February. When March came in her feed was reduced and she was put upon food of less richness. In July of the same year we see quite a change in the per cent of cream. This was caused by the milk being set in deep cans, and the temperature not kept low enough to throw up the cream. Again in February, 1879, we fed to see what she would do for the month, and the result was that we got a pound of butter from thirteen pounds of milk. Her feed was then reduced as before, and we intended to have pushed her again the present month, but losing our barn and feed has prevented carrying out our intention. We are now learning by actual experience the difference between over-ripe late-cut hay, and such as we lost by the fire, of which I shall have something to say later."

INTERESTING FACTS.

VALUE OF CORN COBS.

It was stated at one of the Board meetings recently, that cobs fed to cattle will prevent them from gnawing bones, wood, etc., and it will prevent horses from gnawing their cribs. This led to a discussion of the feed and manure value of cobs, and the majority of the speakers, from personal experience, gave testimony in favor of grinding the cobs with the corn, and of saving all cobs for stock. Analysis gives from 1 to 2 per cent of albuminoids, and about 40 per cent of carbo-hydrates. The ash is from 2 to 3 per cent, of which about one twenty-fifth is phosphoric acid, and nearly one-half potash. A pound of cobs contains about one-sixth as much of albuminoids as good hay, one-third as much phosphoric acid, and two-thirds as much potash.

In this connection is given a concise letter from Dr. Collier, in regard to the composition and value of corn cobs: —

DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C., March 22, 1879.

JAMES O. ADAMS, ESQ.

My Dear Sir, — As to corn cobs, let me send an analysis just made by me of corn-cob meal; i. e., ground cobs with no grain upon them: —

Water	14.42 per cent.
Oil	72 " "
Sugar	2.62 " "
Zeine	2.33 " "
Gum	1.07 " "

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Cellulose (soluble) and starch	41.62 per cent.
Cellulose	36.10 " "
Ash	1.12 " "
	100.00 " "

As will be seen from the analysis, there are present several constituents, in appreciable quantity, of acknowledged nutritious value; while under the head of "Soluble Cellulose and Starch," constituting 41.62 per cent, we have a substance which in all probability may undergo digestion and assimilation, but concerning the real function of which little, at present, is known, and repeated and careful food experiments with the live animal are needed. It is, however, of importance to add that a very large percentage of our best grasses consists of this same form of cellulose, which is not starch nor common cellulose, but a substance readily dissolved by weak acid solutions. There is but a small quantity of starch present, and the same is true of the grasses.

This much seems well established, and this is, that corn-cob meal, instead of being a worthless addition to corn meal, does possess a positive nutritive value of its own, and it may be that this value is much greater than is commonly supposed. Sincerely yours,

PETER COLLIER.

COMPARATIVE COST OF THE STALKS AND GRAIN OF INDIAN CORN.

Joseph B. Walker of Concord communicates the following statement: —

"The following figures, based upon a table of the chemical ingredients of the grain and stalks of Indian corn, found on page 215 of the Report of the Connecticut Board of Agriculture for 1876, afford an interesting revelation of their comparative cost, and aid in solving the question as to the greater desirableness of large and small varieties in our New Hampshire farming.

"Fifty bushels of grain, weighing fifty-six pounds per bushel, contain: —

00.6 pounds of sulphuric acid, worth at 3 cents per pound	$0.02
16.5 pounds of phosphoric acid, worth at 10 cents per pound	1.65
00 8 pounds of lime, worth at 1 cent per pound	.01
5.6 pounds of magnesia, worth at 2½ cents per pound	.14
10.4 pounds of potash, worth at 7 cents per pound	.72
44.8 pounds of nitrogen, worth at 20 cents per pound	8.96
Total value of ingredients of grain	$11.50
Total value of grain at 75 cents per bushel	37.50
Profit without regarding cost of labor, etc.	$26.00

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"A corresponding amount of stalks, say two and one-half tons, contains: —

7.8 pounds of sulphuric acid, worth at 3 cents per pound	$0.23
34 5 pounds of phosphoric acid, worth at 10 cents per pound	3.45
26.0 pounds of lime, worth at 1 cent per pound	.26
16.9 pounds of magnesia, worth at 2½ cents per pound	.42
62.4 pounds of potash, worth at 7 cents per pound	4.37
31.2 pounds of nitrogen, worth at 20 cents per pound	6.24
Total value of ingredients of stalks	$14.97
Total value of stalks at $6 per ton	15.00
Profit without regarding cost of labor, etc.	$0.03

"It appears from the above, that, aside from all expenses of the crop, except of fertilization, the grain has afforded a profit of twenty-six dollars, while the stalks have just about paid the value of their chemical ingredients and yielded none. It should therefore be the aim of the corn-producer to raise a given amount of corn upon the least possible amount of stalks. This will be most likely to be realized from eight-rowed varieties planted in hills not more than thirty-six to forty inches apart."

HOW TO USE CHEMICALS.

The following is from J. W. Sanborn of the college farm at Hanover: —

"How to fertilize, is a question of increasing interest with our farmers. Unfortunately, it is a difficult question to answer; one that no one specially informed upon the subject would undertake to give arbitrary rules for. I am frequently asked by farmers who are using purchased chemicals, what to purchase and in what proportions to use. It is quite evident in the present history of fertilization, that an intelligent (or approximately accurate) answer must be based upon a knowledge of the soil and of the crop to be grown; not that we should base advice upon the composition of the crop to be grown, for that as a guide to a proper method of fertilization has been proven fallacious. The accumulated knowledge of the special feeding characteristics of plants is now full enough to be taken as an indication of the proper proportion of the various materials to use, but only as an indication, for this important point is very far indeed from being settled.

"By desire of others, I will state the proportion of materials I use on a clay-loam hill-soil, for corn. So far as any farm may be termed representative, the farm in question is a fair representative of the hill-farms of the State, having a tendeney to 'bind out to white top.' I will premise by stating that I use only one half as much yard manure to the acre as formerly, thus keeping more of the farm under the plow, thinking that it is the more profitable method. The following materials for the immediate crop are expected to more than compensate for the diminished amount of yard

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manure used per acre: 150 pounds of sulphate of ammonia, 4½ cents per pound, $6.75; 60 pounds of muriate of potash, costing $1.20; 120 pounds of dissolved bone-black, costing $1.92; and 180 pounds of fine ground bone meal, costing $3.60. Total cost, $13.47.

"I should with much confidence expect, on such a farm as described, a very good and profitable crop, when the above fertilizers were used in connection with ten loads, or five cords, of manure per acre. The above proportions are given as the result of some experience on a farm of the kind stated with the crop named, and from a wide collection of accurate experiments of others. It will be noticed that I have based the proportion on the supposition that the corn crop, under good culture, will gather one-half of its nitrogen from natural sources, and that our upland clay-loam soils will, with the known ability of the corn crop to help itself to potash when it is at hand, furnish over one-half of potash supply. A heavy dose of phosphoric acid is given, for the reason that observation has conclusively shown that such soils in our State are not supplied with an abundance of available phosphoric acid. Where a soil is deficient in any material, an overplus has to be used, for various good reasons; also it seems to be established that corn responds favorably to its use.

"For sandy soils I would double the amount of potash used. For wheat I would not use more than one-half of the potash used for corn, and would either increase the nitrogen, or decrease the supply of bone meal. For the same area I would use less of the dissolved bone and bone meal; for potatoes, decreasing the nitrogen slightly and phosphate supply. While what would be termed a full formula of nitrogen for potatoes would not give probably as large amounts of increase for proportions of over one-half nitrogen as one-half or under, yet it often pays to use more, for the amount of nitrogen in a hundred bushels of potatoes is small. Last season it paid me to use full-formula amounts, for the reasons given, although one-half the quantity of nitrogen gave a greater proportionate increase than full quantity.

"Of the phosphoric acid supply, a small proportion is used in a soluble form to start the crop, the balance in fine ground bone. While the relative value of dissolved and undissolved bone is not accurately settled, it may be considered as certain that the same amount of money expended in bone meal will furnish as much available acid the first season, and very probably more, and leave a large unexpended balance that will be available in coming seasons."

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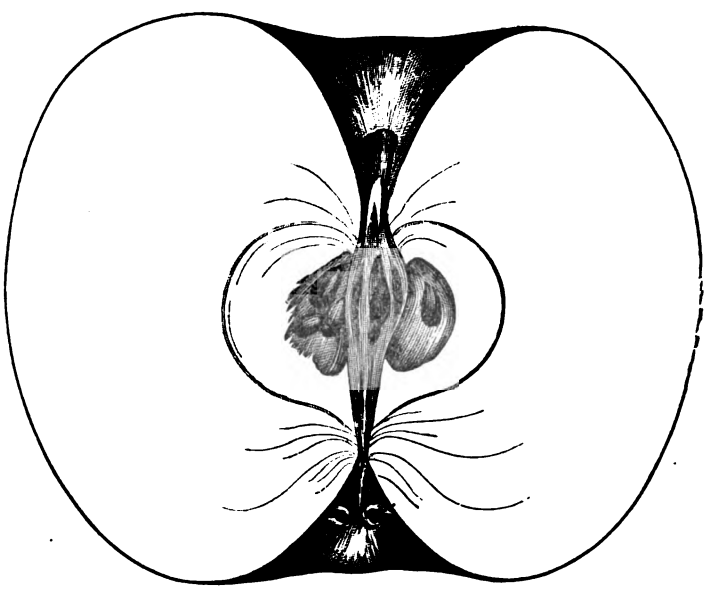
THE CALEF SWEET APPLE.



THE above is an accurate representation of this valuable winter-sweet apple, sketched and engraved by Charles A. Walker of Boston, from a specimen of the fruit furnished him. It does not vary one-sixteenth of an inch from the original.

This apple originated in Kingston, Rockingham County, N. H., on land now owned by Samuel Calef of Exeter, formerly a part of the old Calef farm, from which it derives its name. It is in some localities known as the Magoon Sweet, having been grown by a Mr. Magoon of East Kingston, and marketed in Exeter, and in Amesbury and Haverhill, Mass. It is popular and highly

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prized wherever known, and has been disseminated, by way of scions, in six or seven different States recently.

I know of no other *winter* sweet that will at all compare with it in desirable qualities; it cooks sweet and leaves an abundance of sweet sirup in the dish. The tree is perfectly hardy and healthy; the wood is short-jointed and very hard, resembling, in these particulars, that of the Danvers and Green Sweets. It makes a thick top if not thinned out, and bears heavy crops of uniformly fair fruit. It is inclined to set in clusters of from three to five on a spur. Season from November to March.

J. J. Thomas, author of the "American Fruit Culturist," to whom specimens of the fruit have been recently furnished, gives the following description in the "Country Gentleman" of Nov. 11, 1880: —

"Large (over three and a half inches in diameter), roundish oblate, regular, smooth, and fair, and remarkable for the depth of the cavity and basin; light yellow, with a few large brown or greenish dots; stem very short, reaching only half the depth of the cavity; calyx rather small; basin scarcely wrinkled; flesh yellowish white, a little coarse, quite sweet, and good in quality. Is much better in quality and keeps much longer than the common green Pound Sweeting."

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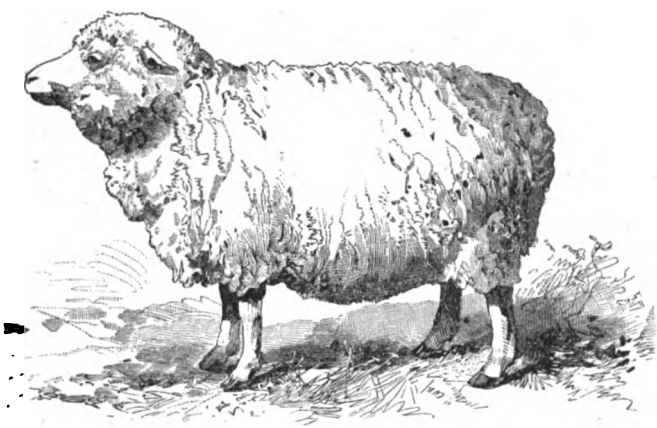
CROSS-BRED SHEEP.



No. 46. — Bred by H. H. & J. L. Gerrish, of Webster.

THE accompanying statement is made by the breeders: —

No. 46 is a full-aged, cross-bred ewe. Her dam was a Vermont Merino, and her sire a small, well-bred, fine-boned Canada ram; bred by Ex-Gov. Armstrong. He was bought for a Cotswold, but should judge by his appearance that he might have had Leicester blood in him.

This ewe will weigh, in good store condition, about one hundred and thirty-five pounds. She has sheared ten pounds and fourteen ounces of unwashed wool; her last four clips weighing thirty-nine pounds and fourteen ounces, lacking only two ounces of forty pounds.

The keeping has been simply good hay and fair pasturage.

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We have bred this kind of sheep successfully for twelve years, increasing slightly the weight of fleece; and we have also been able to select about twice as many nice ewe lambs this season as we could during the first few years of breeding, and that from a less number of ewes. In 1878, ten best breeding-ewes and a ram sheared ninety-two pounds and thirteen ounces. In 1879, same number sheared one hundred and one pounds and three ounces. The present season the same number produced one hundred and two pounds and five ounces. These sheep are perfectly hardy, our flock being taken to the barn Nov. 24, for the first shelter since the 23d of April.

We have lost no sheep in the last two years, and but two lambs; one killed by accident, and the other, a deformed twin, was purposely destroyed.

We are at present using rams unrelated to the flock. Have bred rams, coupling a Merino ram with a Canada ewe, which was selected from about twenty, brought from the Dominion for that purpose.

Our flock numbers only thirty-eight, as we stock our home pastures with Jerseys.

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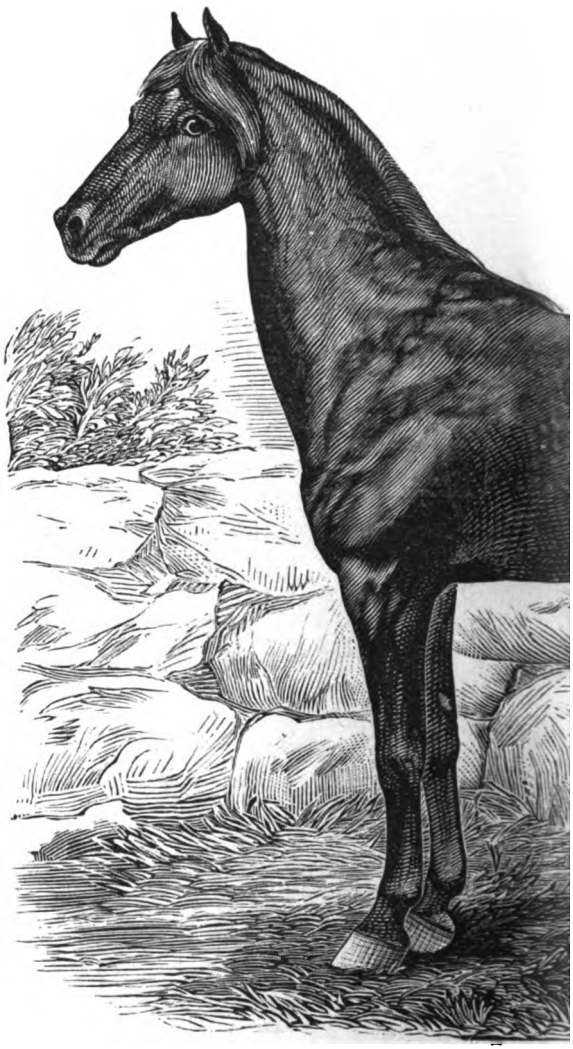

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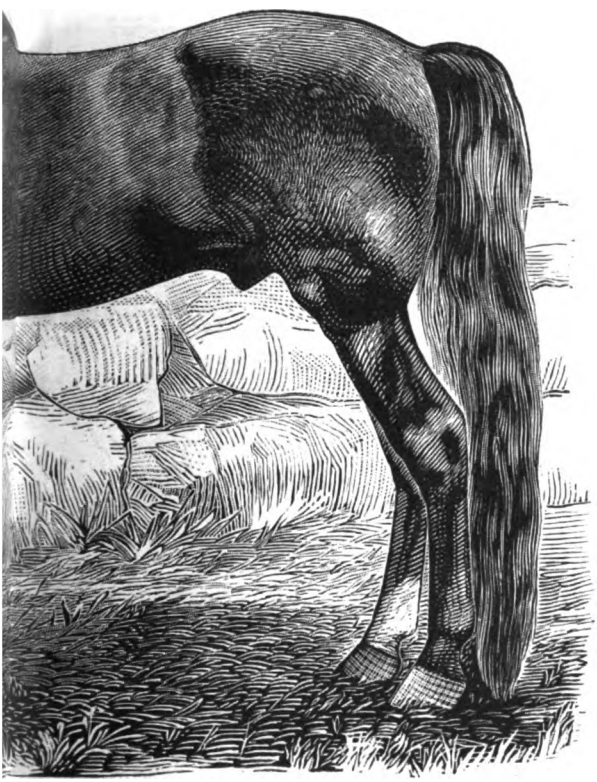

WN HARRY.

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BROWN HARRY.

THE Black Hawk stallion Brown Harry (see illustration) is of a dark, rich brown color, with black points, heavy, wavy mane and tail, one white ankle behind, and white crescent in the forehead. He stands 15¾ hands high, and weighs, in fair condition, 1065 lbs. He is a very strong, handsome, well-finished animal. He has a nervous temperament combined with resolute courage, is a free, spirited driver, and very stylish in harness. His gait is easy, smooth, and elastic, which is a distinguishing trait of the Black Hawk family.

He was foaled June 17, 1856, at the place of P. M. Jefferds, Foxcroft, Me., and is recorded in Wallace's Trotting Register, vol. 3. His sire was Thurston's Black Hawk (recorded in Lindsey's Essays on Morgan Horses as "Young Black Hawk"), by Hill's Black Hawk, by Sherman, by Justin Morgan. His dam was a sorrel pacing mare called Fanny, formerly owned by H. Woodward of Lowell, Mass. She was said to have been bred in Pomfret, Vt., by an Arabian horse from a Morgan mare, yet all efforts to trace her breeding have proved unsuccessful.

At two years of age Brown Harry was taken to Lowell, Mass., and kept some four or five years, when he again passed into the hands of Mr. Jefferds, by whom he was kept one or two seasons at Foxcroft, Me., and then sold to Mr. S. D. Cushman, of Dexter, Me., who kept him until the winter of 1875, when he became the property of G. M. Stevens, of Lancaster, in our State. His speed was never developed; yet after closing a busy season, he trotted a third heat in a race on the Bangor, Me., track during the fall of 1865, in 2.35¼, the last half in 1.16. Two of his get are in the 2.30 list; viz., St. Elmo, 2.29½,

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and Cora F., 2.28. One of his daughters is the dam of Emma B., which last season won twenty-three heats in 2.30, and better, securing a record of 2.22. As a sire of first-class, stylish roadsters, Brown Harry stands second to no horse in New England, and but few others have done so much to improve the general horse stock of the country where he stood, as has been accomplished by him.

He stood for about thirteen years in Piscataquis County, Me., yet so great was the demand for the class of horses bred from him that nearly all of his colts were sold at high prices and taken out of the State to be used as gentlemen's roadsters. At the Maine State Fair, in 1868, he was considered next to Gen. Knox, the best stallion in that State, and his son, Prince Harry, was awarded first premium for best four years old exhibited at that fair.

Brown Harry is at the present time as sound, vigorous, and active as a colt, and bids fair to have several years of usefulness yet before him.

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THE OUTLOOK OF AGRICULTURE.*

BY FRED C. PARKER, B. S., OF THE COLLEGE OF AGRICULTURE, 1879.

IT is well at this season of the year for the farmer, when his barn is filled with plenty, and cellar and granary are overflowing with the fats of the earth, to look around and see what the signs of the times are; to take notice of the condition of the markets, and inform himself whether the labors of the husbandman have been rewarded in other states, in other nations, as amply as they have in his own immediate vicinity.

When we consider the abundant harvests in our own beloved nation, and the scarcity in Great Britain and others, we are pleased indeed, not at their misfortune, but at our ability to meet their demands for food. We are greatly interested at present in the products of English agriculture, since we are shipping weekly large supplies of beef, wheat, mutton, corn, and nearly all the products of the soil, to England. "The crops of the American farmer are looked upon as so sure that all anxiety for food-supply for those less favored, has passed away. Besides feeding nearly fifty millions of our own people, the agriculture of our country has supplied our commerce with a very large proportion of our exports to foreign countries." The effect of this export trade is incalculable. It has done much towards restoring us to a firm financial basis, prosperity, and honor, of which the American people may justly feel proud. This wonderful increase of surplus farm products of the United States, and our consequent ability to export large quantities, is already alarming the political

* Extracts of an address at the Lempster Town Fair.

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economists, statesmen, and agriculturists of the Old World, and discussions have been had as to the best manner of restoring their once proud positions. Their lands are becoming less fruitful, their farmers restless and poor, and at last the burden of unprofitable agriculture has fallen upon England, — the land which has boasted that, by wise legislation, skillful management, and judicious investments in improvements, she was worthy to be called the agricultural leader of the nations, and already have they commenced to emigrate to this country, and more are expected to follow.

Notwithstanding England has purchased millions of dollars of artificial fertilizers and feeding-stuffs, yet the testimony of one of her best authorities on agricultural subjects, Mr. Lawes, is, "that 'high farming' is not able to meet the difficulties that beset English agriculture."

Wherein is the difficulty? Manifestly, it seems to me, in the "ownership" of the land. There the land is owned by a few lords and members of the aristocracy. No man will work with the same degree of interest upon a rented farm that he will upon his own. Landed aristocracy is foreign to all improvement in agricultural practices. It is only where the ownership is vested in the people that we have true independence. "The reason why French agriculture is so prosperous is that it has more than four million land-owners, — peasant proprietors," and this ownership has developed an individual improvement.

More than ever is our system of land-ownership to work to the advantage of the American farmer. The improvements a man makes become his own; he has more courage and heart to labor that he may add to his possessions and beautify his home. The business outlook for the American farmer, then, is flattering, and we should be blind indeed, did we not see the rise and advancement of farming in this country to be sure and certain, and a still greater demand for nearly all the products of husbandry. We here in Lempster are plainly interested as a town, and as individuals, in this matter, because we aid in furnishing the food, not for this town and State, but the whole world. Truly can we say that our market is the world. If, then, there is to be an increasing demand upon us for agricultural products, we must see

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to it that we are prepared to meet these demands. This will require well-directed, energetic, skilled, educated labor, and this is a point which I desire to consider in its relation to agriculture and the social standing of the farmer. It is a law of political economy that profitable labor requires intelligence, whereas ignorant population is cursed by superstition and conceits which shrivel manliness and cancel thrift. Government, by fostering the means of education, and by the diffusion of knowledge among all classes, acts wisely and judiciously; because it fits the so-termed laboring portion of society better to demand and secure their rights, in exchanging services with capital. It cannot be denied that capital at times takes advantage of the ignorance and immobility of laborers, and sometimes secures their services at a less rate than the just relation of capital to labor. In the whole sphere of exchange, the just and comprehensive rule will be that when men exchange services with each other each party is bound to look out for his own interests, to know the market value of his own service, and to make the best terms for himself which he can make. Capital does this for itself, and laborers ought to do it for themselves; but if they are persistently cheated, they have nobody under heaven to blame but themselves so long as we have such facilities for education and intelligence. A distinction should be made between educated and skilled labor. Skilled labor does its work mechanically, and facility is acquired by a perpetual repetition of the same thing. The trinket-makers of China and Japan have skill, but they are necessarily stupid, narrow, and starved. They know but one thing; when that dies, they die. Not so with the educated laborer. He is ever on the alert for something new, ever reaching for some invention with which to relieve toil and make his labor more productive, ever grasping after new ideas, ever seeking a new and better way. It has been said that only so far as intellectual endowments may be transmitted can the babe of civilization be regarded any less a savage than the babe of barbarism; but it is our schools and colleges, and other institutions for the acquisition of knowledge, which transform the child of civilization into a philosopher, and lead out his latent energies into the sunlight of truth and make him a *man*.

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In this age of scientific research and general culture, all nature seems to welcome and court anything which will unlock the hidden treasures which lie concealed in her natural vaults, where they were first placed by the Great Architect and Builder. The crying need of the times is for men of thought and action in all fields of labor. As modern intelligence becomes more widely disseminated, it is found that the farmer cannot thrive on ignorance, while other callings are demanding higher intellectual culture.

It is not germane to my purpose to discuss the advantages of the various ways in which a suitable education can be obtained, but in the light that there is to be a constantly increasing demand upon us for agricultural products, bear with me, while I consider those branches which I think will promote the interests of an intellectual farmer, socially, morally, and financially. "Many of nature's laws may be learned by observation and experience, but others are recondite and can be mastered only by careful study."

A knowledge of chemistry, physics, and mathematics is indispensable to the highest interest of skilled workmanship. The skillful artificer must understand the properties of the materials with which he is working, and the action of nature's elements upon the same. He needs to know something about botany, plant-growth, and how plants feed; how to combine the different elements into fertilizers so as to make them available as plant-food. In the subjects of entomology, geology, mineralogy, and meteorology should he be informed, because all of these are intimately connected with successful farming; and a knowledge of the classics will by no means hurt him. He also must become acquainted with the laws of trade, and especially the functions of money, so that he will know better than to adopt any greenback scheme such as has been endeavoring to make itself popular for a few years past. He needs general culture also, for he will establish relations, both business and social, with the intelligent and educated, exert an influence of no inconsiderable importance upon the character of his associates, and hence he is under obligation to maintain a position worthy of respect and confidence, — especially if he would contribute to the advancement and upbuilding of the calling which he has chosen. It should not be for-

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gotten that the profession never determines the quality and character of the men who are in it, but the men determine the character and standing of the profession. "The fault, then, dear Brutus, is not in our stars but in ourselves if we are underlings."

One thing is clear to my mind: Farmers ought in some way or other to associate themselves together more closely than they have ever done, for the discussion of farm topics, and mutual protection and support. Lawyers and doctors have clubs or societies for the promotion of those affairs which are of interest to their respective callings. Clergymen and teachers form associations for the discussion of new and old theories of theology and science. Journalists have their organizations for recreation and mutual benefit. Shoe-makers, iron-founders, and who not, have societies for the furtherance of their individual good.

Bringing the matter into the domain of agriculture we find state societies, dairymen's associations, granges, boards of agriculture, national farmers' congress, farmers' clubs, etc. All these are for the advancement and upbuilding of this calling, but some of them fall far short of the laudable purpose for which they were established. Why? Simply because the farmers have allowed themselves to be humbugged and led around by the nose by some scheming politician or other gentleman having axes which he wanted ground. Then there is another thing: Agricultural exhibitions have too much connected with them that is foreign to agriculture. Horse-trots, dog-shows, balloon-ascensions, oftentimes are made ten times more prominent than those things which are purely agricultural.

I like a good horse as well as any one can; and if any number of men wish to associate together for the purpose of improving the breeds of horses, why, by all means, let them do it, but don't let them come to agricultural fairs and take two-thirds of the money which is offered as premiums for agricultural products. The judges of our state fairs are selected to give premiums, not to the best articles always, but to some shrewd individual who wants to become popular in the eyes of the people. Those who are unfortunate enough to be outside the "ring" have to take a "back seat," and if they have a superior article little is heard

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about it from this impartial source. Do not understand me to say that these fairs are a failure and detrimental to the interests of agriculture. I do not wish to belittle what has already been accomplished by them, but I know how easy it is for designing men to pervert the real object of a society, to promote their own selfish ends. Let us have no hypocrisy about this matter. What I plead for is to have our fairs conducted in the interest of agriculture, and in an honest, fair manner. The organization of these local clubs and granges is a step in the right direction. I believe they are a great aid to the progressive farmer. This club, organized only a few years since, has done much towards stimulating the farmers in town to adopt better modes of cultivation. It ought to be more generally supported, because there is not a farmer in town who would not be benefited by belonging to it, nor is there one in town who could not aid his neighbor and give him wise suggestions.

This is not the only advantage. You would become better acquainted. You would have a better knowledge of agricultural matters and be better informed upon the general news of the day. You would cultivate your social nature, and all those qualities which constitute refined society would be nurtured to your pleasure and profit. Thus would thought increase and the best kind of education be promoted ; thus would production be enhanced and the increasing demand of the people be supplied. By co-operation and association can the farmers of any community secure better returns for their labor. The profits of farming depend materially upon the business tact and skill which the farmer has to successfully market his produce. It is a fact that a great share of the productions of the soil falls into the hands of speculators, and it is true, too, that they receive a greater share of the profits than the farmer who scattered the seed and patiently waited and watched for the blade and the full corn in the ear.

Do you not know that when by the good fortune of having a friend in Boston in the commission business and you sell your wool or butter in that way, you realize considerable margin over and above what you would have realized if you had sold it to some local agent or tradesman? Hence I claim it would be wise economy for farmers to combine and appoint one from their own

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number, of competent ability and established honesty, to sell their products directly to the wholesale merchant, thereby dispensing with all the middle-men, who buy to sell to some one who buys to sell to some one else, and so on.

It is your privilege to pick out from the mass that class which you wish to feed and supply with the necessaries of life, for purchasers are always in accordance with the article offered for sale. He who sends produce to market in a marketable shape will never suffer loss from any delay of the article on its way to the consumer. But poor produce will sift its way down through all the different grades until it has found its true place; that is, the poor in the city consume the inferior produce and of course can pay but little for it. Always produce a good article then, and purchasers will not be found wanting. You cannot afford to spend your time and devote the use of your land to the production of inferior products. You have heard of the man who cheated his horse by putting green glasses on him and then fed him shavings, expecting that the color would make him think it was grass. Now while that man may have been successful, we don't believe it a good rule to adopt, for in the end you yourselves will be cheated. No: this cheating principle is not a good one. Feed your stock well, and furnish your plants and crops with an abundance of all the elements which enter into their construction and development. Adopt the best modes of culture. Call to your aid all the light which chemical science and experimental practice can bestow. Seek the best breeds of cattle and sheep for your own peculiar taste, and facilities for rearing and perfecting the same; in short, be a friend and supporter of every improved method which modern agricultural science, in all its manifold branches, scatters so profusely to followers of rural pursuits. Perhaps it is in this connection that I may properly speak of a subject which is at the present time agitating the agricultural writers and students to no little extent. I refer to the exhaustion of the soil and fertilizer question. Great interest is being taken in these by men of profound learning and established scientific ability, and a great variety of experiments have been tried to determine the extent of exhaustion. It is generally conceded that our soils are deficient in phosphates,

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nitrates, and the salts of potash. These elements, of such absolute importance to the perfection of plants, if to be no longer furnished by nature must be supplied by the hand of man, and it is a subject which the thoughtful farmer and careful student of agriculture must solve for himself as to the most economical method of supplying these plant-foods. Whether it is better economy to purchase the commercial fertilizers, such as Bradley's, Coe's, or Stockbridge's, or purchase the elements in a pure state of which these are composed and combine them yourselves, is a question to be considered by you as to its financial bearing. Some contend, and back their statements by experimental proof, that it is more economical and better results are obtained by using only half the amount of barn-yard fertilizer generally employed and then depend upon chemicals for the remaining supply of plant-food.

It may seem strange to some that we should speak of feeding plants as we do ourselves; but the ten million little rootlets with their ten million little mouths which reach out after nourishment in mother earth, are just as eager for something which will suit their peculiar taste as the epicurean is for the delicacies of the season.

It is on this subject of the exhaustion of our soil that some think that they see the downfall of our country as the agricultural feeder of the world.

While we are rejoicing at our present prosperity, we may, by exporting such enormous totals of farm products to foreign countries, be doing that which is detrimental to our best and truest interests. But if the American farmer would expend the money which he receives from these exports for the elements of fertilization, and also if we would build up a still more varied industry so that our farm products would be consumed at home, it seems to me that coming generations would have handed down to them a soil akin to primitive richness; and I believe that the Yankee nation is shrewd enough to see to it that our unparalleled growth and prosperity, and our institutions of liberty, freedom, and justice shall not die out, even as they have from the ancient cradle of civilization. No: the nation will stand, and our proud position will be as a light set on a hill shedding light unto the nations of the earth.

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One thought more and I am done. There is manifestly a need of more capital in farming, because capital is at the very foundation upon which rests successful and profitable cultivation of the soil. Farmers are too apt to lay their money away in savings-banks instead of expending it to improve their farms and farm implements. Yes: some seem to think that the only purpose for which they were born was to hoard up a few hundred or thousand dollars; and then, as they cannot take it with them when life's course is run, they leave it, oftentimes either to be squandered by their children who have been screwed down on the sixpence principle or for a bitter contest in the courts. True, a little money is a good thing for that rainy day in the dim vista of the future, but it is not the chief end of man. No: man was born for something nobler, better. When you are increasing the fertility of your fields, improving your cattle, and adding to your list of labor-saving implements, by a judicious investment of capital, do not forget to let your house and barn have their full share, but adorn and beautify them with those things which make home pleasant and attractive. Have upon your table a goodly supply of instructive papers and magazines, and on your shelves a respectable number of standard works; and above all furnish your wife with implements to lessen drudgery and hard work in household duties. Do this, and the boys and girls will not be so eager for the city's pomp and glitter, but their farm home will be to them the most endearing spot on earth. It is all-important that these homes be places where principles of morality and religion are inculcated and taught, for if our homes are to be made the mere temples of fashion, if they are to be made scenes of revelry where sister's hand raises the wine-glass to friend's and brother's lip, if thankfulness for blessings received is neglected, if the spirit of religion which first declared the fatherhood of God and the completion of whose creed is the brotherhood of man is disregarded, — woe, woe, I say, to our institutions and liberties. The good influences of our homes will prevail. I demand the testimony of the future, and how gladly does the past approach to endorse the happiness and prosperity of our country in its manifold departments and relations.

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The future of farming is one of brightness, and while it offers no royal road to ease and luxury, yet to the industrious it promises food and shelter, peace and health. Lempster has not been backward in the march of progress. Her sons are scattered far and wide, and however unworthy they may be, let them never have occasion to blush for the record of their mother, as, thank God, they never have. But as the sturdy farmers of your town went forth at their country's call and faithfully battled and won victories for the right, so let them win, as they surely have to-day, victories in peace which shall be no less honorable and glorious, no less potent for the promotion of education and intelligence, justice and philanthropy, truth and religion, than when they followed their country's flag.

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FARM MACHINERY.

BY J. W. SANBORN, SUPERINTENDENT OF THE COLLEGE FARM.

ADVANCING civilization seeks more and more to shift the former duties of the hand upon the head. Controlling and applying the forces of nature to mechanism ingeniously designed to accomplish its purpose, mind has wonderfully and almost immeasurably increased the producing capacity of civilized man. An ever-widening circle of wants, and wider diffusion of the necessities and luxuries of life among all classes of society, have followed a multiplying capacity to produce. Once-considered luxuries are continually passing into the domain of acknowledged necessities. Blessings but a brief period in the past beyond the reach of grandees are now classed among the every-day requirements of the poor. Passing strange, but true, they have come against his prejudices, and often against his physical protests. Mechanical forces are now pushing with unparalleled rapidity into all fields of industry, and supplanting muscular force more rapidly than new lines of industry can absorb it, and faster than society can re-organize itself in conformity to the changed situation. The relation of this result to the individual and to society has given rise to anxious discussion by both social scientists and statesmen. The alarmist, never absent, sees clearly defined in his imagination an idle, hungry, and desperate class, with sword and torch, to give to our civilization a serious shock. But as Tennyson has it, —

"Through the ages one increasing purpose runs,
And the thoughts of men are widened with the process of the suns."

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The weary and physically worn civilization of to-day will be followed by a more refined and leisurely civilization, whose wants will keep pace with the capacity of the mechanism it controls, and that it is for its highest good to direct.

But this thought is not in keeping with the purpose of this paper. "The world moves," and the world of other industries about us is, as Tennyson again says, "Ever reaping something new."

It should not be our part as farmers to sweat in poorly-applied, half-yielding toil. Our physical, moral, intellectual, social, and financial good requires that we should relinquish somewhat of our inbred conservatism, and not rashly, but wisely and prudently, enlist in our aid, to its maximum extent of profit, the forces of nature through applied machinery.

THE IMPLEMENTS OF ANTIQUITY.

It is agreed that in prehistoric times, when social life was slowly and painfully emerging from a state of pure barbarism, the first implement, pick-shaped, was used in the hands of woman, while yet the sole business of her savage lord was the chase. It is thought to have had its origin in Egypt. From this rude agent of tillage has been developed slowly — oh, how slowly! — the plow of to-day. Until within one or two centuries the implements in use were no better than during the height of pagan Rome's prosperity. In fact, in many parts of Asia and in Egypt the implements in use to-day are little or no better than those in use three thousand years ago. The plows of the ancients, as depicted to us, are at their best of rude construction. The most primitive pattern consisted of a crooked stick with the shorter prong sharpened. The Romans had several varieties of plows, of one and two mold-boards, sometimes on wheels, and, although boasting of a coulter and share, were yet very rude when measured by the standard of to-day. With them the *why* of tillage was far better understood than the *how*. Their smaller tools consisted of rude rakes, hoes, mattocks, spades, and harrows. It is worthy of mention that in some instances grain was cut by a wheeled cart pushed by oxen. This machine severed the heads of grain from the stalks and collected them in a box. As de-

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picted by modern artists from descriptions that have come down to us, it was a rude but not wholly useless tool. A genius in Gaul, it appears from history, had actually constructed a machine, which, drawn by two horses, was used for cutting standing grain. In those good old times, as is now done in some parts of the world, and has been done in America in this century, the grain was threshed by driving oxen over their threshing-floor. Horses were in frequent use for this purpose. Under a different name the flail was sometimes used. By an out-door arrangement, constructed with much care, or in an elevated airy place, the winnowing was accomplished by throwing the grain into the open air with a shovel. Hesiod said: —

> "Smooth be the level floor on gusty ground,
> Where winnowing gales may sweep around."

In lieu of the harrow their grain was covered for germination by shallow plowing. Coming up in ridges it afforded an opportunity for hoeing and weeding, a practice considerably adopted. As has been said, genius found expression but to a limited extent in improved farm tools prior to the present century. It is not long since it became necessary to prohibit the Irish boors from making attachment of their horses' tails to plows as a connecting means of draft. Within the memory of elderly persons now living there have come into use the great inventions that have done so much to alleviate the rough toil of farm work, making it possible to produce the cheap food now eaten by the sons of other toil. Within the last decade inventive skill has been particularly active, seeking for mechanism adapted to aid the hand in nearly all the important operations of the farm. So successful have inventions been, and are prospectively to be, that farming is rapidly becoming a fine art as well as a profound science.

MATERIAL VALUE OF FARM IMPLEMENTS TO OUR CIVILIZATION.

The relation of cheapened food, and the redistributed labor saved by farm implements, to the arts and sciences, and to the social and intellectual life of the day, are factors incapable of mathematical estimate. The amount of labor husbanded by the use of labor-saving implements on the farm is a question

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to which an approximate answer could be given. Want of time and reliable material at command forbid the inquiry. In this country they have been to the highest degree of special national importance. Here they have a wider, more varied and skillful use than in any other country, enabling us to become the heaviest sellers in European markets, against nations more favored by location, price of materials and labor. The relation of the great exports of agricultural products to the financial condition of the country, and to the nation's prosperity, is constantly kept in view by the press and by our statesmen. It would not be a useless task to estimate the material wealth saved to the country in days' labor annually by our farm tools, but no accurate figures can be made without much research. During the war it was estimated that the reapers in use did the work of a million men. The census of 1870 represents the farm machinery in use in this country at over one-third of a billion dollars. Since that time the increase has been very heavy. The annual production of reapers was then over 60,000, mowers 39,486 (one firm's annual make now approaches these figures), plows 864,947, grain-drills 32,033, corn-planters 21,709. But much of the success of American machinery is largely due to its nice adaptation to the work to be accomplished, and to the skill of our workmen.

RELATION OF FARM MACHINERY TO NEW ENGLAND FARMING.

Heretofore it has seemed necessary to the New England farmer to limit his area of tillage crops, for want of available plant-food. With this area, rock-scattered and broken, he has not considered the amount and character of his tillage grounds to warrant heavy outlays for machinery, especially when it would require the substitution of the otherwise non-producing horse for beef-producing oxen. The oldest, most infertile, yet most enterprising section of the Union, we should expect to find New England wealthiest in ingenious methods of wresting from an adverse soil crops that should fully meet competitive prices of more favored sections. Yet we find by the census of 1870 that the proportion of farm implements to value of farm land was as 1 to 25.9, while in the West it was as 1 to 27.1. In

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New England, per farm hand, there was $71.80 worth of implements. In the West, $85.40. The great value of Western implements is made up of those great labor-savers, — reapers, drills, corn-planters, seed-sowers, and improved horse-hoes. Where are these used in the East? We have, however, a possible future. A more prosperous era is about to dawn upon New England farming than it has ever known, to come through the freer use of capital in a broader system of tillage. It is madness to break our muscles against the machinery of the West in its free scope of use. Let it be steel against steel. Commencing at the foundation, we find our fields must be fitted for machinery, and, where possible, their areas broadened. The changes required by the unswerving "logic of events" have a deep social and civil signification, and will mark a wide change in the social status of the farmer, and in farm life. It may be a pity, but it must be; the few acres of the humble cottager for profit fade into broader acres, inviting the concentration of capital and skill, where the wear of metal fills fourfold the wear of muscle, where the rattle of much machinery is exchanged for the song of many voices.

I believe in large farms for profit, in extended instead of concentrated areas of tillage, and, as one of the absolutely essential factors of profitable farming in New England against the West, the free employment of labor-saving devices. Perhaps neighborhood co-operative use of implements may be arranged for small farms. Some way, into the warp and woof of our system of farming must freely enter the ingenious labor-saving machinery now and prospectively to be available. For our highest good in every sense, financial included, mind, the director by virtue of its high gifts and power, should not enslave the muscle to labor that it can delegate to baser agencies.

MACHINERY REQUIRED.

Long emblematic of our industry, for ages the correct use of the plow has been recognized as the most important operation of tillage. That old Roman, Cato, said: "The best cultivation of land is *good* plowing." What is the second best? "*Plowing the ordinary way.*" What is the third? "Laying on

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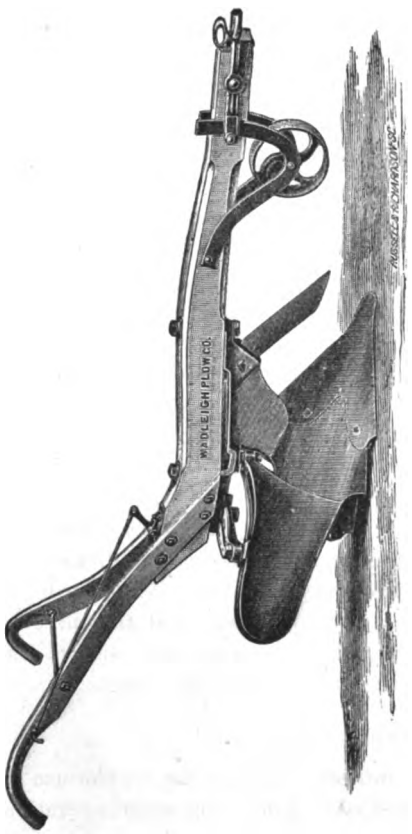
manure." More emphatic still was Jethro Tull, during the last century, in ascribing to thorough culture a higher place than manuring. And in this century all good farmers recognize the high importance of thorough tillage. It is not my purpose to discuss the beneficent effect of tillage. I would observe, however, in passing, that tillage is virtually manuring; opening the soil to accelerate the work of those agencies that have ground the solid rock of past ages into the fine soil of to-day. More obvious to careless observers is the saving made by labor-saving machines, but no more certain is it than that as great a saving is made in increased crops by the free use of these implements in thorough tillage.



The Granger Plow.

Plows and plowing is an old field. The standard plows of to-day on soils to which they are adapted all do good work. Any description of them would be of detail too long for this paper. An objection made to swivel-plows has been that they execute a decreased amount of work, and present as much labor for the team and more for the holder than the landside-plow. Some innovations on the methods of swivel-plow construction have been made, most of which I have

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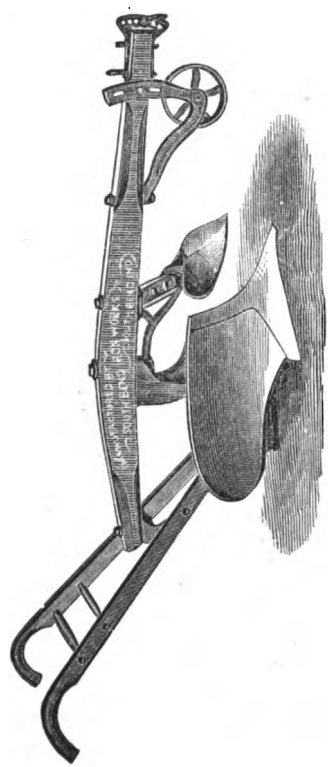
tried. With me on alluvial clay the Granger plow has been most successful. By the cut on the preceding page, you see that the mold-board is made in two sections, the forward section swiveling under the beam as in ordinary plows, the rear section circling around the rear of the plow. Thus a double-faced mold-board is required, admitting, of course, of construction like the landside-plow. Easy of draft, this plow gives, or executes, more work than swivel-plows of the old style. I am pleased with the work of the plow. Objections to it may be named in weight and complexity. All these objections, I think, are overbalanced by the gains made by its peculiar construction.

The adamant, or chilled, is another recent advance in plow-making. Presenting a polished surface, its friction is light; being also of a very durable material, its cutting edge is maintained keener than would be the case in the quicker wearing character of the plow it seeks to displace. This is no inconsiderable gain, for the draft of a plow is made very largely in cutting the perpendicular and horizontal sides of the furrow.



The Oliver Chilled Plow.

The gang-plow has been used with success in New England by a few persons, notably Dr. Sturtevant. In answer to a letter of inquiry from me, he expresses his continued satisfaction in its use. A successful gang-plow is, of course, an economical machine, inasmuch as it executes twice the work with the same driving that a single plow would. Provided it requires an extra horse, it is

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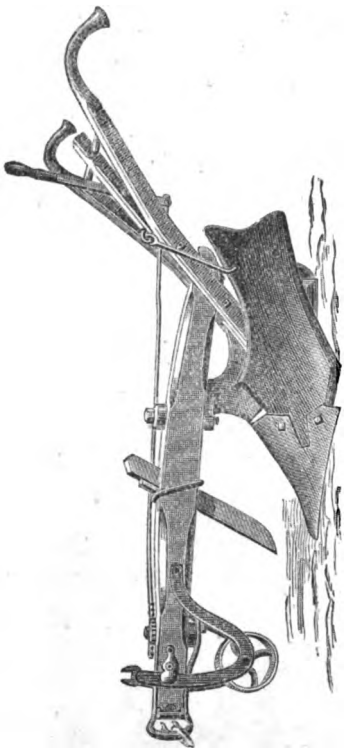
yet very desirable, affording an opportunity for the driver to ride, and dispatching the work quickly and with economy, as will be observed by a little mathematics. Certainly on very stony fields it will not work to advantage. In any event our fields must be fitted for machinery. This seems to be an absolute requirement that we cannot dodge and hope for success.

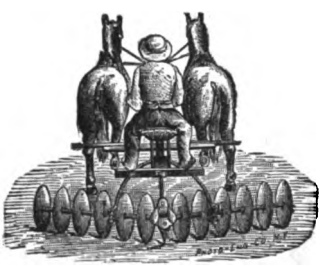


North American Reversible Plow.

I assume that none will think of buying a landside-plow, through whose dead furrows all following implements must work to disadvantage. The ungainly places once made will always remain; not likely to occur in the same place each succeeding year, the field soon tends towards a continuous succession of these unsightly spots.

IMPLEMENTS FOR PREPARING SOIL.

A soil free from clods or turfs, deep and mellow, is the object sought in preparing the ground for crops. The old historic square-toothed harrow, laden with the recommendation of ages, comes before us, and, notwithstanding its turf-rooting and fine-soil-packing proclivities, boasts, even now, of its wide-spread use. But it, too, must go, and temporarily be crowned the Randall or La Dow,



The La Dow Harrow

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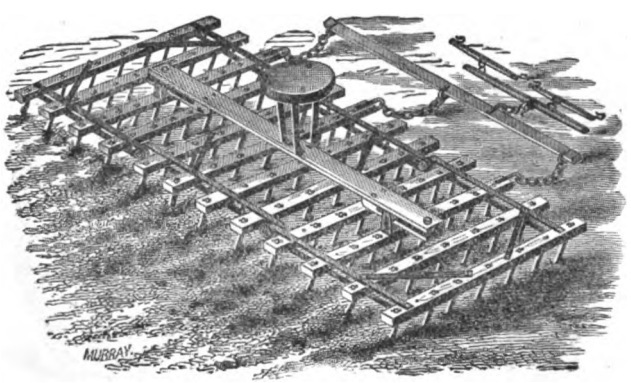
deep and quick pulverizing harrows, leaving a mellow, sodless land of enhanced producing capacity. The illustration shows their mode of construction. The concave steel discs, or plates, revolve at an angle to the line of draft; thus a lifting and loosening motion is given to the soil. The shape and motion of the plates insure rapidity of work. You will notice in the cut a characteristic tendency of the age, — an opportunity to ride. These implements should be upon every farm. But they spread so slowly that one is reminded of the poet's statement in relation to science, and is compelled to believe the picture is quite true of art in some of its departments. He has it: —

"Science moves but slowly,
Slowly creeping on from point to point."

While the harrows recommended, because thought to be the best on the market, are deep and quick, they are not thorough pulverizers on heavy land. To complete the process of fining the soil, for it must be completed for profit, I use first a clod-crushing drag seven feet in sweep and five feet wide. The bottom of the drag is made uneven like the clapboarding of a house, the laps being ten inches long and dropping two inches



Hughes's Castor-Toothed Harrow.

in front. This gives a rolling action to the clods, and thus fines them. This implement, for the purpose, I consider superior to the roller, as the weight of the roller comes upon one point and

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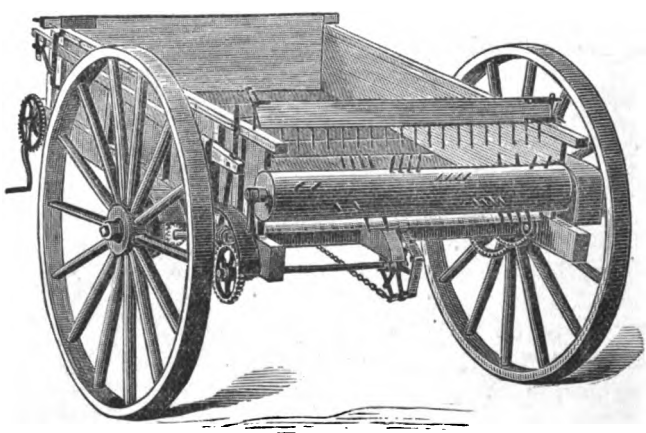
packs the soil overmuch, and pushes the sods and turfs into the soil quite frequently, in which shape they are more pernicious than before. Following the drag, if necessary, should come the Thomas smoothing-harrow, whose many fine teeth have a backward slant. There are other harrows for the same purpose. Among others I have in mind the Bradley reversible.

The soil is now fitted for the crop, and so far as mechanical fit is concerned, it is better prepared than very many gardens. Such a fit insures a thorough distribution of and commingling with the soil of the manure used. In such a soil plant-roots may revel. With gates ajar and food at every entrance, they are invited on, gathering with unfettered liberty of the rich stores of food before them.

When a grain crop is sown, I follow the sowing by the drag before named, or a smooth-bottomed drag, to keep the dirt around the seed, insuring moisture and food within the reach of the tiny baby roots of the small grains.

FERTILIZER-SPREADERS.

And now one of the principal outposts of the domain of the manure-fork is threatened with invasion. Kemp's manure-



Kemp's Manure-Spreader.

spreader is certainly an effective machine, not only spreading with mechanical precision, but doing better still, — performing

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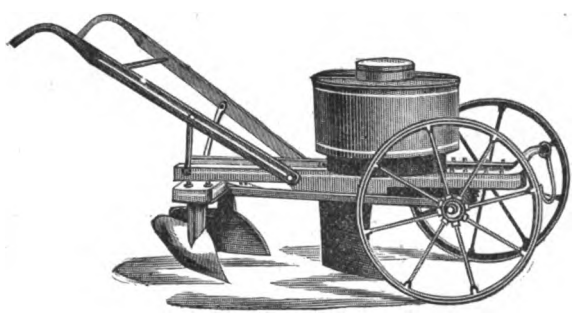
that most valuable service of fining the manure. That virtue will cover a multitude of faults, for everything temporal must have faults. Its cost — one hundred dollars — will put it beyond the reach of many, for the interest would spread the manure of many farmers. A lighter load must be drawn to the field, for a considerable power would be required to run it; particularly in the spring, on turned sward, would it run hard. Again, the manure must be spread when drawn. But it does its work, and for those who like the conditions against it that have been named, it will most certainly prove a welcome aid. The bottom of the cart consists of lagging somewhat like the treadmill of horse-power threshers. It is made to move slowly back as the team moves on. The power is applied from the wheels rolling not only the manure back, but turning a spiked cylinder, against which the manure presses. The motion of the cylinder flings the manure to the rear of the cart.

The heavy use of plaster and ashes in some sections of the country, and the rapidly increasing use of commercial fertilizers, have created a demand for a distributer of these materials. To fill this want several machines have been put upon the market.



Randolph Fertilizer-Distributer.

I have representations of a few. Upon the merits of the various machines I shall not attempt to pass. I have no hesitation in commending them to you, for very much of the success of this class of fertilizers, certainly of the chemical manures, depends upon evenness of distribution. This object is accomplished by this machine more perfectly than by hand. It may

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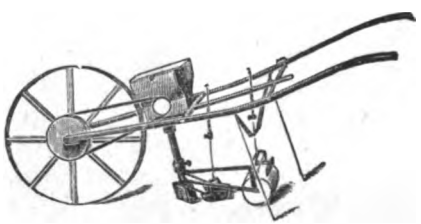
be thought that the work to be done will not warrant the outlay. Then let the machine become neighborhood property. I will add that the use of chemical manures is to rapidly extend; that our agriculture cannot, in justice to itself, struggle along without them, and with them it cannot well do without one of these handmaids of our art.

I may say before leaving this department of farm machinery, for the benefit of those who will yet for a time pursue the old methods of planting, that there is a little implement, the Randolph fertilizer-distributer (illustrated on preceding page), that those who use fertilizers should not be without. It is a hand machine that spreads the fertilizers in a circle of about a foot around the hill of corn or potatoes, leaving in the center a vacant spot for the seed. It presents a neat and expeditious method of putting the fertilizer in a most effective position.

SEEDING-MACHINES.

I will name first in this family of machines one of the humbler members, the garden seed-drill, — a cheap and effective little implement that will do much to take the edge from most men's dislike



Arlington Seed-Sower.

of garden-making, sowing quickly in drills not only garden seeds, including peas, but corn-fodder and seed for the root-crops. Certainly many farmers, and at least most neighborhoods, should have one.

Rising to a broader field we find various devices to fill the place of the original seeder, and we find the cunning of the hand mastered by the mechanical precision of our grain seeders or sowers, at a great economy of time. First in order we name

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the hand seed-sowers, costing five to six dollars,* in expeditious hands sowing three or more acres per hour. But the horse-power seed-sowers remind us that this is not an age of manual labor; and, thanks to the consideration of the inventors, our fertilizer-distributer is quickly converted into the sower. We vote one for every community, and, duly installed, we see our modern kid-gloved book-farmer mounted on the seat in the shade of his big umbrella, singing "Yankee Doodle" as the old mare glides swiftly over the field, scattering his hope of harvest.

Philadelphia Hand Broadcast Seed-Sower.

Of the grain-drills I wot not what to advise. Good farmers in England still broadcast,— a land where the elements are favorable to weed growth. We find opposite conditions here, and withal an aid to clean culture in the smoothing-harrow. Having hoed a little by hand for a couple of seasons, I feel like seeing the benefit fairly demonstrated before buying, under our favorable conditions for broadcasting.

Perhaps no seeding-machine saves so much labor as the potato-planter — opening, cutting, dropping, dropping fertilizer, and covering at the speed of a horse at walk. After two years' use I should be glad to be able to conscientiously recommend it, for it would be so great a boon if perfected. The one objection to it is held a virtue by most — it seeds light per acre. I am confident, however, that it is an objection that outweighs its great aid in planting. By giving it an adjustable dropper it will become a machine of paramount importance.

* See Vol. VI. for illustrations of Goodell's manufactures. — Sec.

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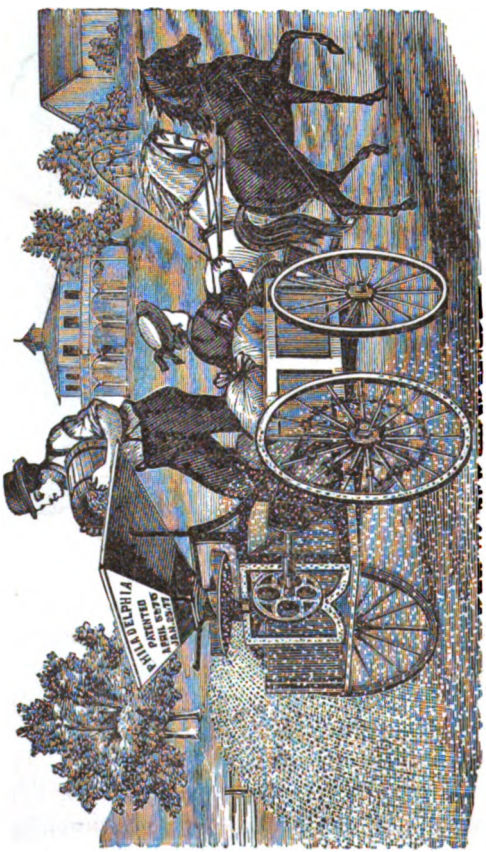
The crowning glory in the group of seeders is the two-rowed corn-planter. For twenty-five cents per acre it will open, drop



Philadelphia Horse-Power Seed-Sower.

corn and fertilizer, and cover, doing the work dollars better than when done by hand. The seed is in the ground, much below the surface level, where its roots can get food and anchorage, and be less subject to drouth. Again, this position of the seed is absolutely necessary for the successful use of other machinery to follow, that I am to name. Planting in drills, it insures a larger crop than when planted in hills. Two hills of two

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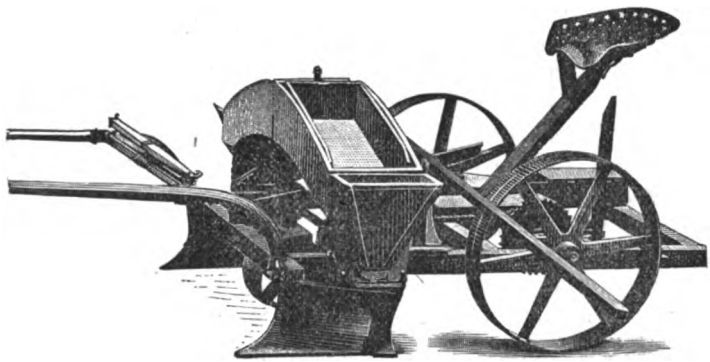
seeds is better than one hill of four seeds. The chairman of our Board is, I think, the inventor and maker of the only two-rowed planter in our market.



Humphrey's Two-Rowed Corn-Planter.

The advantage of a two-rowed machine over a one-rowed planter is very considerable; one man planting two rows, against two men to one row with the latter machine.

IMPLEMENTS FOR CULTIVATING CROPS.

An inquiry into the relation of cultivation to the growing crop, while of great importance, must be omitted in order to confine this paper within due limits.

At the very threshold of inquiry we are called upon to bid adieu to that glorious old instrument, the hand-hoe. It has filled its mission except in a very much limited sphere, and now must give way to horse harrows and hoes for cultivation. The use of the harrow in cultivation, particularly for corn, is seemingly so unnatural a practice that it has given rise, to my personal knowledge, to much bitter ridicule, yet it is certainly a very successful practice. Looking over the literature of cultivation I am reminded that agriculture boasts of its lost arts as well as other more presumptuous industries. These words of Columella must sound very queerly to the ears of some moderns. He says: "We must not omit a particular method of plowing at this time practiced in Italy beyond the Po and introduced by the injuries of

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war. The Sallaci, when they ravaged the lands lying under the Alps, tried likewise to destroy the panic and millet which had just come above the ground. Finding that the situation of the crop prevented them from destroying by the ordinary way, they plowed the field, but the crop being double what it used to be taught the farmers to plow amongst the corn." Pliny advises to comb the corn with a harrow. In the use of the harrow upon the grain-crop I have but little practice, but by those who have the system is highly spoken of. I will follow the management of the corn-crop through to harvesting in a brief way. We have planted it with a two-rowed planter. Its shoe has thrown a ridge on either side of its track and has planted the seed over two and one-half inches below the surface of the ground (not covered two and one-half inches deep). We wish to level the ridge about the corn-row, referred to, and pack the mellow surface soil slightly, in order to decrease the liability of the corn being covered by drawing in the loose ridge over it and also of being rooted out by the harrow that we propose to use. For this purpose I have used the roller with great success, but in practice use the drag before referred to, just as the corn begins to break the ground. This gives a most excellent hoeing, destroying all of the sprouting weeds and leaving a beautiful surface, and fit for the coming harrow. This is hoeing No. 1. After waiting about a week the Thomas smoothing-harrow,* consisting of seventy-two round steel teeth set slanting backwards in a light frame, with a reach of ten feet, is then applied. With the drag, a man and pair of horses hoed twelve acres per day; with the harrow sixteen acres are completed in a day, in a most thorough manner, eradicating what the hand-hoe does not do, the weeds in a hill, for every particle of the surface ground is stirred. This operation is repeated every five to seven days until the corn is five to six inches high. To this point the work is done perfectly. The corn is now high enough to allow dirt to be sprayed among the stalks by a horse-hoe. A long one is needed that will run steady. This is spread up to the very borders of the row, and used to either cut or cover lightly all the space between or in

* We have no cut of the Thomas harrow, but refer to Hughes's castor-tooth, used for the same purpose, which has eighty-four crooked, slanting teeth that are movable in their sockets. — SEC.

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the rows. The final operation consists in the use of a hiller, not for the purpose of hilling, but to insure the spreading of a light film of dirt over any weeds among the hills that may have escaped the horse-hoe. After the harrowing I have used the Ross system of cultivation. I have illustrations* of all these machines and of several others that will undoubtedly do good work. The Ross system costs unreasonably high and should be made slightly stronger.

Planet Jr. Horse Hoe.

I will review the cost of cultivating an acre of corn, including planting. Planting, one hour, horse and man; dragging, horse and man, four-fifths hour; harrowing three times, two-thirds hour each time of man and pair horses, two hours; cultivating and hilling, one and one-half hours, each operation, or three hours, horse and man; or a total of six and four-fifths hours man's labor and eight and four-fifths hours horse labor. This outlay I am convinced will give larger crops than costly hand methods. During the drouth of the past season, by continuous use of these implements the continuity of the capillary tubes formed by the rapid upward flow of water to supply evaporation was kept broken and evaporation checked. In short, the ground was mulched by these comparatively shallow cultivation implements. In case of an excess of moisture, deeper-stirring tools would dry better the surface ground for the surface layer of roots. It is very rarely that we wish to curtail the water supply for corn on ground adapted or fitted for its growth. The best improved implements for the cultivation of corn are friends whose intimate acquaintance we cannot too soon seek.

The cultivation of potatoes without the aid of hand-hoes is a very simple art indeed. When planted below the surface of the ground the harrow is followed by a hiller with perfect success. Besides the Ross hiller referred to there are several effective implements for the purpose of hilling; among others an excellent implement represented by the cut on next page, and made in

* We have no cut of the Ross hoe. — Sec.

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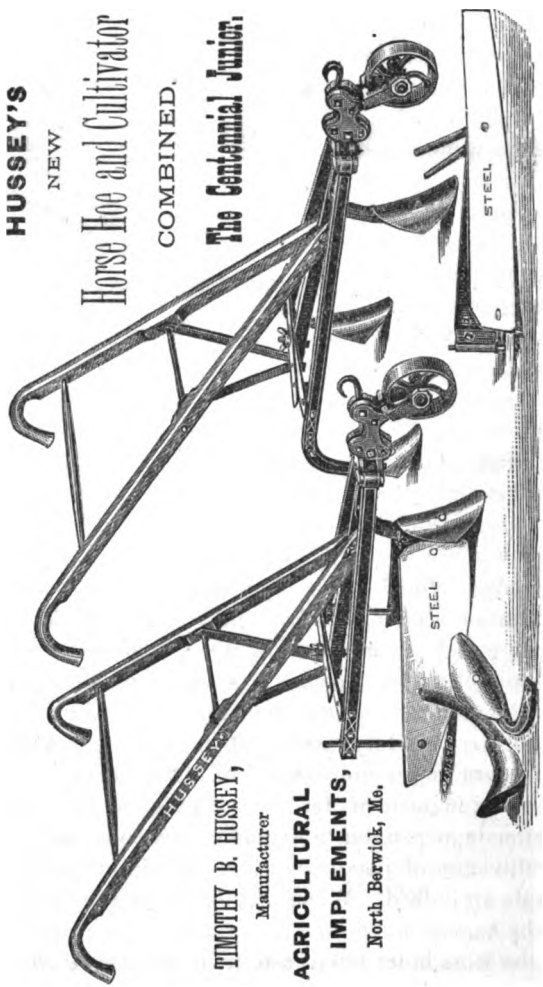
South Berwick, Me., by T. B. Hussey. I find no necessity of planting below the surface for successful cultivation by horse-power. It is desirable when the harrow is to be used.



I have from Ross & Co. an exceedingly useful wheel-hoe for use in the garden and among the root-crops.

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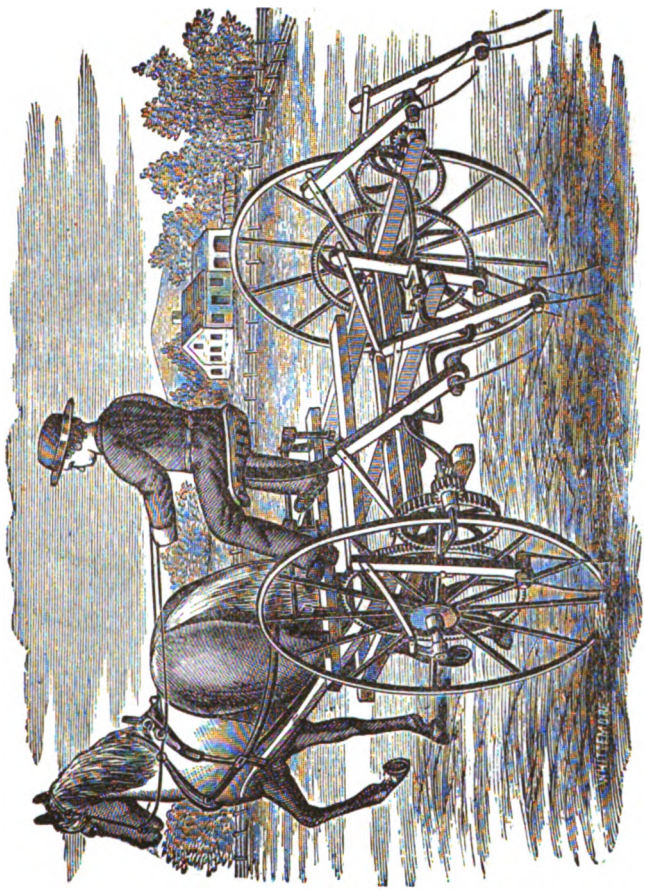
HARVESTERS.

This subject opens up a wide field for discussion. I shall not attempt to enter it very fully, for it is not the purpose of this paper to consider machines in general use. Thus we pass the



mowing-machine, horse-rake, and perhaps tedder, as machines universally recognized as required in practice. The cost of the tedder limits its use.

Among other aids to hay-harvesting is now being introduced

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the hay-loader. Its working is clearly seen by this illustration. I have not seen it work, but have heard good reports of it from a neighborhood near me where it has been at work. I have no advice to give in regard to it. The hay-fork, while generally known, is little used. I have in use a very effective one, Gardner's horse railway fork, and can say of this class of implements that they are hand-labor-saving but not money-saving tools, except to a very limited extent.

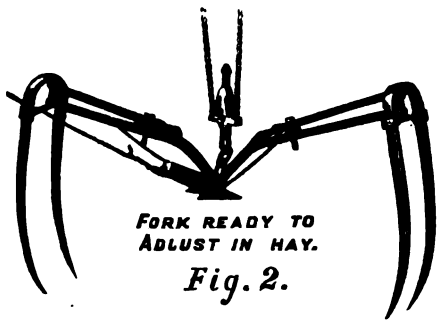

Fig. 2.

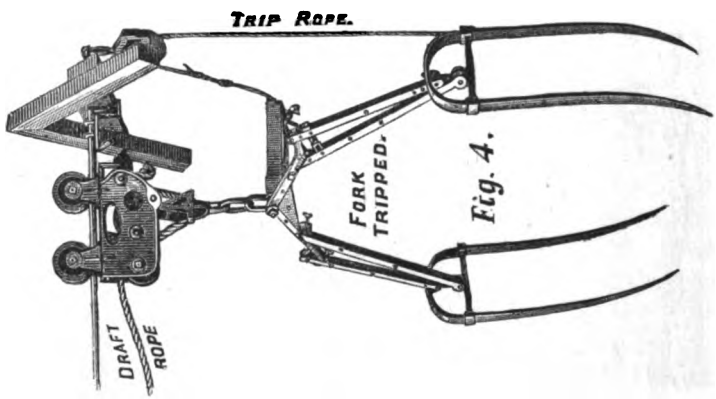

Fig. 4.

Gardner's Horse Railway Fork.

Many patterns of potato-diggers have been put upon the market, but none have as yet achieved such signal success as to rapidly extend their use. I saw recently in a foreign paper an illustration of a machine that I doubt not will do good work. I cannot now suggest a machine that I can recommend, and will content myself with the advice to be in readiness for a surely coming machine, not allowing it to require ten to fifteen years to get your attention. Why, some of the machines that I

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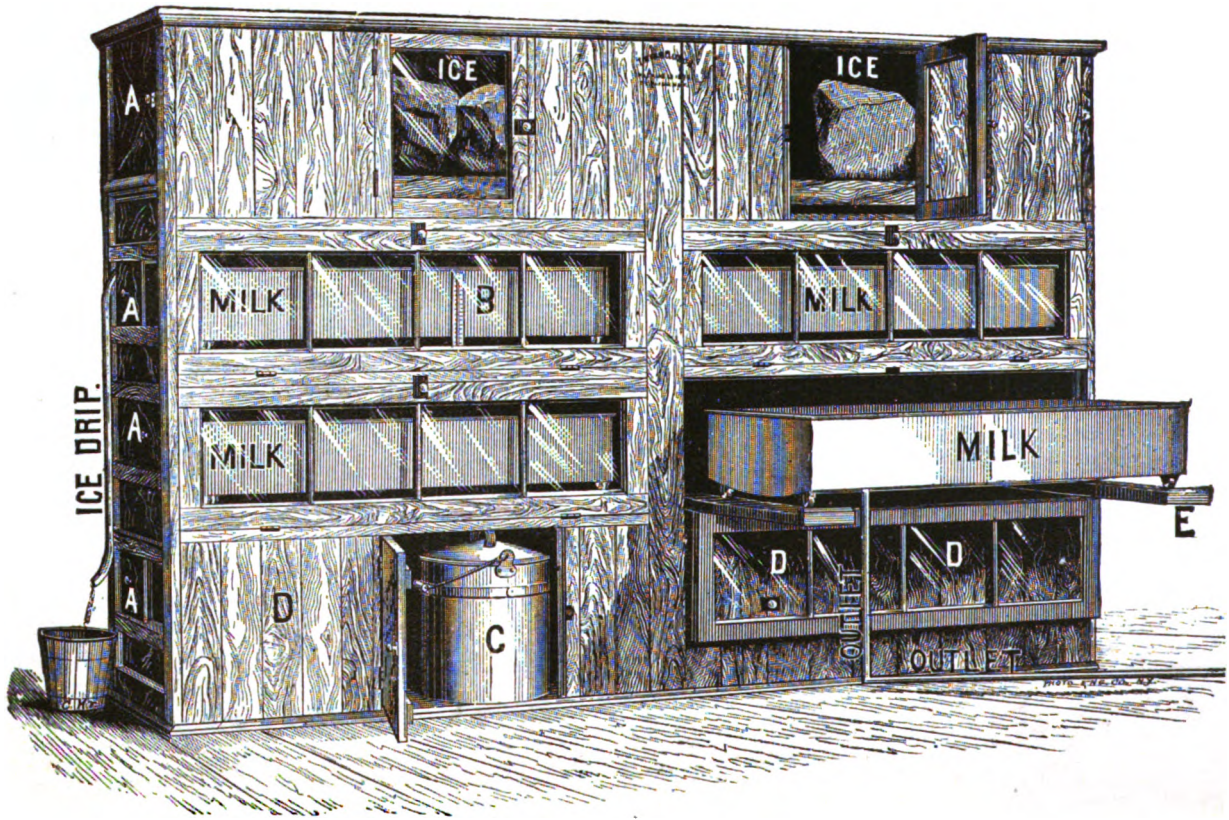

FERGUSON CREAMERY AND REFRIGERATOR. Manufactured by the Ferguson Manufacturing Company, Burlington, Vt.

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have named have been ten to fifteen years in market, and are yet strangely unknown. Conservatism is a good quality, yet, as farmers, the feeling is so strongly imbued in us that we allow it to overcome our better judgment. Boldness to put into action the convictions of a careful judgment is needed among us, to no inconsiderable extent. The reaper has not come into use in the East to any considerable extent, for reasons that are good but not always to exist. A few years hence, when tillage operations shall have heavily broadened, they will wend their way eastward. The machine sadly wanted is the corn-harvester. We have only to wait for it. Coupled with it the fully successful husker, and maize-culture becomes a genteel art, and maize the grand crop of New England. Whittier sings the praise of the corn-crop in just language: —

> "Heap high the farmer's wintry hoard,
> Heap high the golden corn;
> No richer gift has autumn poured
> From out her lavish horn."

Indeed, corn-huskers are now in the field. I have employed the Phillips spiral husker. It is by no means a failure. Costing substantially as much to husk with it as by hand, it affords but little inducement to employ it, as husking is not disagreeable work. This is true of other machines, that they save nothing in expense, but they are a necessity of the situation. In the absence of needed labor in sufficiency at a time of general activity like harvesting, they fill the place of laborers. In answer to my inquiry Mr. Ross says: "I have forty acres of corn; much of it was out in the recent snow-storm; what could I do without it?" Corn-culture is bound to increase, and this question of Mr. Ross may become general. Other means may be suggested. In fact, some inquirer has tried common threshers with the cylinders set wider apart than for grain. By this method the corn is not only husked but shelled. Provided the practice is successful, it would be troublesome to preserve the shelled corn.

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OTHER IMPLEMENTS IN GENERAL FARMING.

Among the lesser implements I name one that has given me much satisfaction, — the Eureka post-hole digger. It is a grand little implement, and saves much time and labor in setting posts, unless rocks abound quite freely. The Lightning hay-knife is of such easy execution in work that it is almost a delight to use it. The improved grain separators and cleaners now built ought to be in every neighborhood, if for no other purpose than to fit our spring seed for sowing.

There is an abundance of lesser tools for special departments of farm industry that can be well afforded: also heavier machines, having a somewhat limited field; notably, steam and wind power — more especially steam power. Changes first, but with capitalized farming a use for steam power will clearly be seen.

IMPLEMENTS FOR THE DAIRY.

In primitive agriculture, in times of barbarism, woman was the motive power of the farm. In modern agriculture, and under the benign influences of civilization, man and machinery have become the motive forces. In direct farm duties her last lingering work is in the dairy, from which she is fast being eliminated by recent developments in dairy practice. Now, for the benefit of the ladies I have to say, let your husbands know that the old tin pan has been weighed in the balance and found wanting, and that it, too, must go, in company with his antiquated out-door tools.

The Lily Butter-Worker.

It ought not to be necessary to commend a butter-worker. Strangely enough, however, the dairies of this State that are without one are in a vast majority. The milk-pail and stool combined I consider to be an acquisition to the dairy, and I am very much pleased with the merits of the conical strainer attached to it. With these, and paddles and pounders, the harder dairy work goes smoothly in the hands of men.

I cannot now discuss questions in dairying, or systems of

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setting milk. The success of deep-can, cold settings of milk is now demonstrated. It lightens the duties of the dairy-room. The milk is strained into the cans at the barns, and set into double-walled chests, iced in summer. When cold running water is available it is set in cold water in summer; otherwise in cold air at 45°, or below.

CAPITAL REQUIRED.

It is accepted as a truism needing no argument that the capital is generally wanting, and not easily forthcoming, to stock our farms with tools as fully as required for the best results. Knowing well the character of New Hampshire farmers, I am clear in the conviction that they are more than equal to such an emergency, and once determined to have they will master the way to get it. The reason has not been truly assigned, want of capital; rather is it inertia, born of conservatism and want of faith in and knowledge of the merits of the aids proposed. I will give a list of machines advised, drawn partly from the manufacturers' price-list and in one or two instances from memory. In this list I do not include the machines in common use, like plows, mowing-machines, etc.

Gang-plow	$90.00
Randall or La Dow harrow, steel discs	35.00
Clod-crushing drag, home made	2.00
Smoothing-harrow used for corn-hoeing	20.00
Horse seed-sower and fertilizer-distributer	25.00
Garden seed-drill	5.00
Corn-planter, two-rowed	40.00
Horse-hoe	10.00
Horse-hiller	7.00
Post-hole digger	5.00
Lightning hay-knife	2.00
Grain cleaners and separators	25.00
Implements named for the dairy	25.00
Total	$291.00

Of this total, the cost of the winnowing-machine, corn-planter, gang-plow, and fertilizer-distributer may be borne by the common ownership of a community. Subtracting this sum of $180

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and we have machines that each will have to own costing only $111. To the machines named many will want to add: —

Manure-spreader	$100.00
Potato-planter	40.00
Hay-fork	15.00

In a few years will have to be added, perhaps the grain-drill and hay-loader, certainly the potato-digger and corn-husker. The full list of implements named imply fitted fields, stock-feeding, purchased fertilizers, wider tillage, more capital, more skill, and, most welcome, more profit.

THE WITCHCRAFT OF GOOD CROPS.

Way back through the vista of ages into pagan times, a freedman and a genius in husbandry grew larger crops than his neighbors, for which they hailed him to court to answer a charge of witchcraft. He stood in the forum with a stout daughter, excellently constructed iron spades, spears, and other useful tools, with his oxen, and said: "These, Romans, are my charms." Our civilization has outgrown his method, found a higher sphere for her cultured maidens; yet the profound appreciation of this freedman of thorough culture with the best implements at command, has not been dimmed by over two thousand years of gathering experience. The farm mechanism of to-day hath gathering charms with which the genius of our people will wrest with ease, from an obdurate soil, generous returns.

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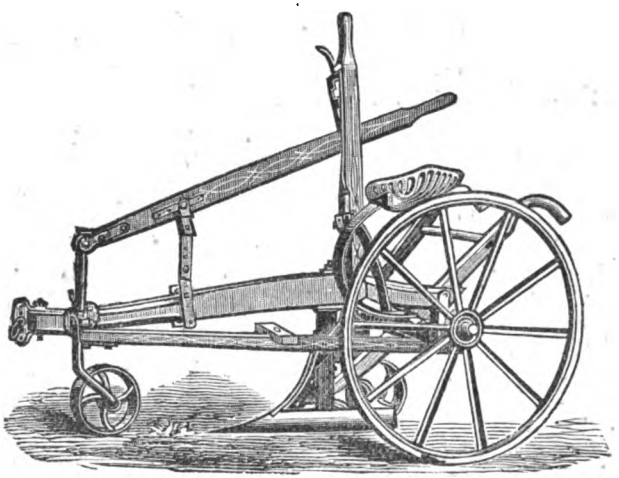
NOTES BY THE SECRETARY.

Mr. Sanborn is not to be understood as endorsing every machine represented in his paper. When he has tested an implement, he has given his opinion of it.

"The sulky-plow attachment" — McBride's — he had not tried when his paper was written. He has since had reason to



The Sulky Plow Attachment.

pronounce its working a success. The attachment may be applied to the Oliver chilled, or any good landside plow, and can be made to do good work on any land adapted to the ordinary process of plowing. It holds itself, and will turn a perfect furrow if the team is well managed.

"The Ferguson Bureau Creamery," which is represented in the paper, Mr. Sanborn has not used, but commends the Hardin system, with which he is familiar. The Ferguson has strong claims on dairymen, and is rapidly gaining favor. The inventor and manufacturers claim that it is the most perfect and complete system ever offered; that it is a safeguard against the injurious effects of temperature and climate, to which our New

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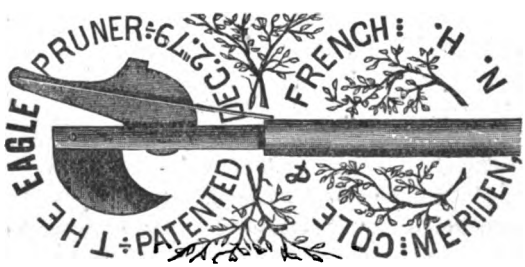
England States are subject; "a compact, convenient, labor-saving, and sensible method of securing the utmost possible yield from the dairy and an increased price for butter." This is what they claim and what many practical men who have used it admit.

The apparatus consists of an upright bureau or refrigerator, thoroughly made, with double walls. In the upper part is a rack for holding a supply of ice, and a metallic pan with rubber tube attached, for conducting off the waste water from the ice. Immediately below are four large pans, each pan having a capacity for the *whole milking* of a dairy. Around each pan is sufficient space to admit of the free circulation of cold air from the ice above. The pans stand on suitable rests, and are each provided with metallic castors, so that they may be easily drawn out of the bureau on two movable rests, for skimming or drawing-off.

Below the pans is a closet or refrigerator for cream and butter, with a capacity for several tubs. A can is furnished with each bureau, to be used for warming the bureau in cold weather, by filling it with hot water and setting it in the closet at the bottom. A lamp may be used to keep up the temperature if needed. Each end of the bureau is provided with ventilators for controlling the circulation of air in the bureau.

The bureau is furnished with glass doors, permitting the proper admission of light. A thermometer is provided for regulating the temperature.



The pruner here represented is a new article that will readily find its way to the gardens and orchards of progressive cultivators. It is a home production, as will be seen by the names in the illustration.

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DISEASE AMONG DOMESTIC ANIMALS.

UNTIL within a very few years our State has been remarkably free from disease among farm animals. In a small section of Carroll County, in consequence of a deficiency of phosphoric acid in the soil, neat cattle have suffered and finally died, when kept for a series of years without change of location. We had in 1864 a few cases of the "lung plague" brought in from Massachusetts by animals sent to our mountain pastures. But the disease was effectually suppressed without serious loss.

The foot and mouth disease once crossed the State line in another portion of the State, but was readily met and mastered. On one occasion, Texas cattle introduced the Spanish fever into the city of Manchester, but the Board of Agriculture by authority interdicted the bringing of animals from the infected region into our State, and no more loss was sustained.

But within the past five or six years, while there have been no known cases of contagious or infectious diseases prevailing among neat stock, frequent and often serious losses have been sustained from sudden and sometimes long-continued distempers in various portions of the State.

In the spring of 1874 a number of young animals and some milch cows and working oxen died in the northern section of Sanbornton, from what was called malignant catarrh. Not long after, unexplained causes — perhaps the "black quarter" — took away young cattle at Dorchester, Thornton, Conway, and other places. In the town of Temple, four or five years ago, cows and oxen belonging on the Melendy farm, adjoining the Hillsborough-county farm, died in a few hours after showing signs of any affection. Similar cases have occurred annually

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until nearly thirty animals have been lost on this single farm, while a few have died on the neighboring estates. The cause of the disease has not been ascertained, but there is a probability that the animals were poisoned by wild-cherry leaves, or some plant growing on the farm. So fatal has been the malady and so long continued, that the owner has abandoned his original plan of making it a stock and dairy farm, and is designing to raise sheep and horses. The farm is capable of supporting one hundred head of cattle, having good pasturage and an abundance of English grass and stock hay.

Disease prevailed in a special locality in the town of Tuftonborough, two consecutive autumns. The cases were finally fully investigated by order of the Board, and such measures adopted as to prevent its recurrence the present year.

The following letter from Dr. Mason, who with others made an investigation into the case, will give a clear statement of the matter: —

"*J. O. Adams, Esq.*

"I went yesterday to Wolfeborough. There were quite a large number present from the neighborhood of the disease (if it is a disease), and we went on with the investigation. I went there strongly impressed that it was a poison from the wild cherry (*prunus Virginiana*), the leaves of which contain hydrocyanic acid. At the same time I was prepared to take any other view that the facts in the cases might warrant. Dr. King made the autopsy, assisted by Mr. Coleman, the veterinary physician of that town, of about forty years' practice. Dr. King wrote out the result of his examination.

"Now for the result. These cattle lived but a few hours, as near as I could learn averaging about four hours. None recovered. After examining Dr. King's record I asked him the question direct, 'Did you make up your mind as to the cause?' His reply was, 'I made up my mind that it was poison.' What poison? His reply to this was, that he was not satisfied as to that. He named oxalic acid. I called their attention then to the wild cherry, and after discussing the matter fully, he, together with Coleman, thought that might be the cause.

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"Now you will notice: These cattle were in the same pasture. This pasture has many cherry-trees growing within it. It was a time of year when the leaves would be going through the process of wilting, which is the time they evolve the most of the hydrocyanic (prussic) acid. This acid, when taken in a free state, destroys life in a few seconds But in these cases it was not in a free state, but required the digestion of the leaves before the activity of the poison could show itself. There was nothing in the autopsy to contradict this conclusion, so that I gave them my opinion that it was in this way that the death of the cattle came about, at the same time saying that I might be mistaken and that possibly this might prove to be a serious epizootic in the future. They will destroy the cherry-trees in their pastures and wait the result. I cautioned them not to blend every case of cattle disease or death with these, as that is liable to occur at all times, but to carefully watch every case that might occur in the future.

"I believe I informed you in my previous letter that this is the same pasture where the cattle died one year ago last summer, and they seemed to have died in the same manner. I spoke of the wild cherry at the time, but it seems they did not give it sufficient consequence to destroy the trees. You will see that an infection could not have remained through the winter, which is another proof that the whole thing arises from something growing in the pasture.

"Almost all present gave a good deal of consequence to the idea of poison as described. One man, whose name does not occur to me, asserted and was very sanguine it was a disease. It is quite serious, as some fifteen or more cattle have died in all, and will be still more serious should the case prove an infection. If it is a disease, I do not know what to call it. I think the dangerous growth of the wild cherry ought to be more generally known.

"Yours truly, WM. H. H. MASON."

The following is the outline of the examination:—

"Examine every organ carefully, and note every abnormal appearance.

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"Note the quantity of blood in the cavities of heart, and specify what cavity.

"Examine the veins of diseased leg, whether inflamed or otherwise.

"Whether any effusion in cavities, and if so what cavities.

"Take out the brain without rupturing, and note any effusion or inflammation, particularly at its base.

"Note particularly whether there is any organ sufficiently diseased as to cause death.

"Make the examination so thorough as to be able to describe the appearance of every vital organ."

Result of examination reported by Mr. Banfield: —

"In both the large and small stomachs the lining was considerably disorganized, say over one-third to one-half of the surface; so much so, that it had detached itself to some extent and was mixed with the contents of the stomach. The remaining portions could be removed with the slightest touch. Some portions of the contents had become dry, hard, and caked in small patches in both cavities. Think the smaller more affected than the other.

"The right auricle of the heart contained — should say about filled with — a coagulated clot of blood. Did not notice any in either of the other cavities; should say the heart and veins, generally, except in the diseased part, were normal. Should think the liver slightly disorganized or congested. The whole of the right leg was considerably congested and effused, including the skin, which was inflamed to double or more of natural thickness. Large amount of blood in the diseased leg, which effused freely in examining, extending over the whole leg, hips, and portion of the abdomen. Did not notice blood of any account except as mentioned. In the leg a large quantity and in a fluid state, following the knife in the examination. Should think it a case of poison, which seemed to stagnate blood in extremity.

"Owing to the location where the examination was made, the low temperature, and cold wind, could not make a thorough examination."

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DISEASE IN HAMPSTEAD.

In the spring of 1879, soon after turning out to pasture, several animals, mostly cows, died in the town of Hampstead, on the premises of Mr. Oliver Putnam. These were reported to the Board of Agriculture, with the request that an investigation be made. By request of the Secretary, Dr. J. C. Eastman of Hampstead, and Drs. Adams and Emerson of Manchester, made an examination, and submitted the following report : —

" *To the Board of Agriculture.*

" Having been requested by your Secretary, James O. Adams, Esq., of Manchester, to investigate, so far as we were able, a certain disease that has afflicted cattle throughout the State for a few years back, and having had an opportunity to make a *post-mortem* upon one animal so afflicted, where three animals had previously died with the same disease, we submit the following report. This must necessarily be very imperfect, for want of more material, as it is impossible to ascertain all the facts of so intricate a disease, where so many questions present themselves, from one *post-mortem* alone. We also give a few facts gleaned in reference to the disease in the cows that died previously, and a few comments upon the disease as it presents itself to us.

" Mr. Putnam's farm upon which the *post-mortem* was made is situated in the town of Hampstead, about one mile southeast of the village. The farm is well situated, and the buildings are good and kept in first-rate repair, and everything looks neat and clean as though the place is conducted by live, energetic people. The barn stands up well and has a cellar stable on the south side that is perfectly dry and well ventilated. It was in this stable that the cows were kept. The yard is to the south and west of the barn and is kept neat and tidy. The pasture is mostly high land, there being a swampy place in the cleared portion of it that is small, and about ten acres of woods. There is also a portion of the pasture that used to be mowed as a meadow. There is a good spring, and a brook running from the spring of the clear spring water, to which the cattle have free access. The cattle were all in good condition, and evidently had had good care. There had been no cattle brought

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into the neighborhood from a distance, within a year. There have been no other cases in the neighborhood, within Mr. Putnam's remembrance. There has been no sickness of a similar character among any of the animals in that vicinity.

"The cows were all raised on the farm, and never had been away from the farm to pasture. The first one was six years old and had a calf two weeks old. She was in apparent good health up to Thursday morning, May 15. Thursday afternoon when she was brought up from the pasture she refused to eat. This was the first symptom noticed. She had no evacuation during Thursday night. Friday morning she stood bracing against the stanchion, and when let into the yard she staggered and braced herself as though dizzy. The muscles of her neck would twitch and she would frequently throw her head up and shake it as though in great pain. Her eyes were staring and glairy, but she was not blind. While out in the yard she went to the trough and drank once. She stayed out about one hour, during which time she passed her water and they gave one injection of about one gallon of water containing molasses, salt, and soap, which she retained about half an hour. After putting her into the barn they gave her half a pint of castor oil, and another injection the same as the first, which she retained about one and one-half hours. After this she had a very small movement of the bowels and urinated freely. She jumped around some, pressed against the stanchions, and, at times, had spells of trembling all over (these were evidently spasmodic twitchings of the muscles; the result of irritation of the brain). She was moved out and put into a pen where she had her liberty. A thick mucous discharge from the nose began Friday morning and continued till death. The slight convulsive movements continued at times from this on. Along in the afternoon she braced herself against the side of the pen and began to move backward around the pen (probably she was blind at this time, as running backward is frequently a symptom of blindness in brute creation; fearing danger ahead, they run backward to get away from it). She backed around the pen ten or fifteen times and finally fell and began to struggle (this may have been a general spasm), till her owner knocked her in the head at about eight o'clock Friday evening.

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The second one was a cow four years old and had a calf six weeks old, and the third one was a cow five years old and farrow. They were taken at about the same time, and, running through about the same symptoms, died, the one at eleven o'clock Saturday morning, the other at about eight in the evening of the same day. There was no cough in any of the three cases. The milk began to fall off in the two cases a day or two before any other symptom made its appearance. The above are the symptoms, etc., as given us by a number that saw the cows, some of whom were with them most of the time till they died.

"The cow upon which we made the *post-mortem* was purchased in West Newbury, twelve miles distant, and brought into the neighborhood on the seventeenth day of May, the same day that the last two cows died, and put into a barn about seventy rods distant and kept there till Monday, the nineteenth day of May, two days after these cows died, when she was put into the same barn, and even the same stanchions, where they had been, and kept there one day and night, then turned out with two heifers and one old cow that were in the same pasture where they were kept. Also, another cow was bought in the neighborhood and put into the same pasture. They were all kept in the same barn nights where the three that died had been kept, and turned out daytimes into the same pasture. They all remained well until Saturday afternoon, June 28, 1879, when this one refused to eat and appeared dumpish. Nothing passed the bowels Saturday night. Sunday she appeared quiet most of the day. They gave her half a pint of castor oil at six o'clock Sunday morning, and at half-past ten repeated the dose. At about four o'clock in the afternoon they gave her about one pint of linseed oil. She appeared stupid, with some grating of the teeth, except at times she would have slight convulsive twitchings of the muscles of the neck, and throw her head up as if in great pain. She urinated Sunday night. Monday she appeared a little more restless, pressing her head or horn against whatever might be in front of her, and tipping it backward and forth. At about eight o'clock in the forenoon she laid her head over to the right and closed her eyes as if dead; and, in fact, those with her thought she was dead. She lay in this way a few moments, then rallied

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and had two movements of the bowels. She continued more or less restless through the day. She stood all night Monday night and had nothing pass her bowels, nor did she urinate during the night. Tuesday morning she was very quiet, only throwing her head now and then as above, till about ten o'clock in the forenoon, when she had another movement of the bowels, appeared more restless, and it was discovered that she was blind in both eyes. She had some tenesmus on having a movement of the bowels, probably the result of the medicines she had taken. There was no very offensive smell from the discharge, although some of the party present thought it 'smelt terribly.' At this time her pulse was sixty and full (forty-eight being about the average of the adult cow). Her temperature was not taken, but it could not have been far from normal. Her horns and head seemed cold, and there was quite a discharge of thick mucous matter from the nose. There was no cough. The cow looked shrunken, as any cow would that had eaten nothing for so long a time. Her coat was slightly staring, but not bad. She appeared very weak and exceedingly unsteady in her gait, as though her co-ordinating power and power of equilibrium were nearly destroyed. Her breathing was about normal. When offered water she made an effort to drink, but could not swallow. Her milk began to fall off in quantity one or two days before any other symptom made its appearance. In fact, the symptoms were so well marked that no one with a knowledge of the physiological functions of parts could have mistaken th seat of the disease, and we three physicians agreed at once that there was trouble in the brain.

"After a careful examination of the cow we decided that she could not live, and that it was best to kill her and make the *post-mortem*. We selected a place under a tree about ten rods distant from the barn, and they put a rope around her horns and tried to get her out there; but when she had accomplished about one-half the distance, she fell, and they could not get her up again, so were obliged to load her on a stone-drag and draw her out there. We then cut the carotid artery and let her bleed to death. The examination was made about one hour after death. *Post-mortem* rigor slight. The abdominal viscera were all in

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proper position. The rumen, or first stomach, was comfortably filled with partially masticated grass mixed with more or less fluid. There were no foreign substances discovered among its contents, and its lining membrane was intact, entire, and free from inflammation. (It is not uncommon to find portions of the lining membrane of the rumen thrown off in perfectly healthy cattle.) The reticulum, or second stomach, was about half full of more fluid contents, and its honey-comb lining was complete with its papillated epithelium, and entirely free from inflammation. There were no foreign substances in its contents (the foreign substances, such as scraps of iron, pieces of leather, etc., swallowed by cattle, *usually* lodge in this stomach). The omasum, manyplies, or third stomach, was comfortably filled with moderately dry contents, consisting of the solid portion of the food. It was not over-distended, nor was it very dry. (It is not uncommon to find the contents of this stomach very dry, even dry enough to smoke, in perfectly healthy cattle, since its office is to receive the food after it has been ruminated, press out the fluid portion, and prepare the solid portion for final digestion and assimilation by the next stomach, by trituration and mixing with it a certain portion of its own epithelium. Consequently, dryness of the contents of this stomach cannot be considered an indication of constipation.) The abomasum, fourth, or true stomach, was partially filled with quite fluid contents. Its lining membrane was normal, so far as we were able to judge. There was no inflammation. The small intestines were normal with the exception of about one out of ten of the solitary glands, which was enlarged to the size of a pea and filled with a cheesy contents. The large intestines were normal. The liver was not weighed, but we judged it to be about the normal size. On cutting into it it appeared healthy every way. There was no microscopic examination made of it. The gall bladder contained about half a pint of bile, but the outlet, the cystic duct, and *ductus communis choledochus* were free, so we could readily press the bile out into the intestine. The hepatic ducts were also free. The pancreas, or sweet-bread, was healthy, and pancreatic duct was free, entering the intestine about fourteen inches below where the duct from the liver entered. The œsophagus, or

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food-pipe, was healthy, and the mouth was also healthy, both being entirely free from inflammation except at the upper part of the pharynx, where the mouth and nose come together, there were indications of slight inflammation. The kidneys and suprarenal capsules were healthy. The bladder was empty and healthy. The uterus was also normal in size and healthy, and the right ovary contained an ovum about ready to pass off. The spleen, or blood-gland, appeared normal, both externally and on section. (We think the spleen was perfectly healthy, but, since there are some diseases affecting the minuter portions, we are sorry we did not make a microscopic examination of this organ.) The lungs and pleura were free from inflammation, and healthy so far as we could tell. The heart was about normal size, and the left ventricle contained a small coagulum of blood, which is usually found in *post-mortems* of healthy animals. The lining membrane of the nose seemed slightly inflamed at the lower portion, and as we progressed upward we found the inflammation more intense, till we reached the ethmoidal volutes, which we found as black as lamp-black. The vomer, or septum of the nose, was quite black at its upper portion, but became lighter-colored as we passed downward, from the middle to the lower part looking as though it was thoroughly congested with venous blood. The whole of the ethmoid and some of the adjacent bones were more or less blackened, although they did not seem to be softened very much. On opening into the brain we found the ethmoidal bulbs slightly blackened, and, as we proceeded back toward the middle of the base of the brain, the color was more intense. The membranes covering the origin and a certain portion of the extent of the olfactory, auditory, optic, ophthalmic, and, of course, smaller nerves arising in the same region, were as black as soot. This dark color also extended backward on the membranes to the spinal cord and about one inch down that on the right under side. The optic commissure was blackened clear through the nerve substance, and the other nerves were streaked with black more or less. Where this penetrated the nerve tissue it followed the course of the connective tissue, separating the nerve bundles in every case. This, of

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course, led to the suspicion that the coloring matter was deposited by the blood-vessels, as they are always in the connective tissue.

"Very respectfully, your obedient servants,

"D. S. ADAMS, M. D.
"A. L. EMERSON, M. D.
"J. C. EASTMAN, M. D."

"We saved a portion of the parotid gland, which is situated just behind and above the angle of the lower jaw, and is one of the glands that secretes saliva, and made a careful microscopic examination of it and found it to be entirely free from disease and in a normal condition. We also saved one of the lachrymal glands, which is situated within the socket for the eye and secretes the tears, and found that free from all inflammatory action, and healthy otherwise so far as we were able to judge. Also, we saved two lymphatic glands, one from the neck, the other from the mesentery, the fold of membrane that holds the intestines in place. These are supposed to be blood-glands. We found these free from all disease. We also carefully examined portions of muscle for trichinæ, etc., and found them healthy. When we came to examine the brain we found a very interesting condition, and, hoping that some others will repeat the examination, we will give the methods somewhat in detail. On making sections and examining from the fresh, unprepared brain, we found nothing satisfactory, but, by making thin slices of the brain and hardening them in alcohol for about twenty-four hours, partially drying them, then making sections about the six-hundredth of an inch in thickness in a section-cutter, and rendering them transparent with glycerine, we are able to follow out under the microscope, magnifying three hundred and sixty diameters, the course of the blood-vessels and deposit of pigment. (We speak of this in detail because it takes a much thinner section of this blackened tissue to examine by transmitted light than it does of ordinary tissue.) The deposit of pigment followed exactly the course of the minute blood-vessels, some of them being entirely blocked up with it. The smaller capillaries, two-thousandths of an inch or less in diameter (small blood-ves-

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sels), and some even larger were nearly all, so far as we examined, blocked up with pigment, while those of larger caliber had allowed it to pass out through the walls, where it lay all around the vessels. Also, in all these cases, the white blood corpuscles had passed out of the capillaries and lay thickly packed around their walls. This is the result of inflammation, and considered a sure sign that inflammation has existed wherever it is found. This filling-up of the smaller blood-vessels prevented the blood from flowing through them and produced pressure upon the adjacent nerve tissue. On the under side of the right ophthalmic nerve there was an artery as large as a crow's quill firmly plugged with blood, evidently caused by the capillaries filling and blocking up back into the larger arteries. There did not seem to be any softening of the nerve tissue; probably the pressure had not been continued a sufficient length of time to produce it.

"By making thin sections of the blackened tissue and subjecting them to different chemicals, we obtained the following: In strong sulphuric acid we got first a red, then purple, passing on to almost a black. The tissue bleaches in both chloroform and strong spirits of ammonia. Pure bisulphide of carbon has but little effect on it. Equal parts of alcohol and bisulphide of carbon have but little effect, only bleach the outer portion of thin sections, and do not give any color that can be seen. In nitric acid we got a tinge of blue, and in strong muriatic acid; also, in a solution of ferrocyanide of potassium we got a change toward blue. The chemical examination is not very satisfactory, and, in fact, is somewhat contradictory, but this is commonly the case with colored tissue, since so many other elements besides the pigment enter into the analysis. However, this is sufficiently confirmatory of the microscopic examination to settle the question beyond a doubt that it was deposited by the blood, and is either one of the coloring matters of the blood or bile. The evidence is in favor of hæmatoidin, one of the coloring matters of blood, although it makes no difference practically, since the coloring matter of the bile is derived from the coloring matter of the blood, and both are deposited by the blood when they are deposited at a distance from the liver.

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"From the above we can safely deduct the following: First, there was inflammation of all the membranes at the base of the brain of a very intense character. This dilated the small blood-vessels and allowed them to fill with blood, and the white blood corpuscles to pass out through their walls. This rendered the blood current so slow that the blood coagulated in the smaller vessels and blocked up back to some of the larger ones. This soon undergoes a chemical change, setting free the coloring matter, which stains the tissues. No doubt but that the same changes took place in the membrane of the upper part of the nasal cavity, especially that covering the ethmoidal volutes, although we did not examine this minutely.

"Now for the theory of the disease: It bears very strong evidence of being an infectious disease, that is, conveyed from one animal to another by certain spores or some medium of infection; that the animal diseased sows the seeds by the discharge from the nose, the thick mucous discharge carrying the spores with it, depositing them in the pasture, barn, barn-yard, or wherever the animal may be; that this remains wherever deposited till thoroughly dried, when it is snuffed up by another animal feeding over the same ground or in the same manger, and, the spores lodging in the nasal cavity, it begins here, and from this spreads to the brain and other parts of the system. This mucous discharge might be deposited upon a blanket or robe or anything of that nature, and be conveyed from one end of the State to the other; or, possibly, after it is thoroughly dried, it may be taken up by the wind and conveyed quite a distance; or, perhaps, it might be deposited in a brook and conveyed from one section to another in this way. Now this pigment, or coloring matter, is not necessarily an element of the disease, as we view it, but is more or less accidental, being dependent upon the intensity and character of the inflammation. It is barely possible that it is found in all cases, but should not think strange if it is not. We have looked through two veterinary works,— one by Clater and Armatage, the other by Tullier, — and we find nothing given there that comes anywhere near it. There may be something given in some of the other works on veterinary medicine, or, perhaps, if we should make another *post-mortem*,

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we would find appearances so different from this one that we would be able to place it. As it is, we do not wish to name it; but, having given the symptoms so far as we can, and the conditions as found, we hope some veterinarian, more acquainted with these diseases than we, will be able to classify it and give us some remedy.

"Very respectfully,

"D. S. ADAMS, M. D.
"A. L. EMERSON, M. D."

CASES IN AUBURN.

In Auburn, on the farm of a Mr. Merrill, a case occurred which was known to Drs. Adams and Emerson of Manchester, the parties who investigated the Hampstead cases. They saw the animal — a cow — the day before she died, and made a *post-mortem* examination the day following. They found some of the same symptoms as appeared in the cases reported, though the physicians were not able to decide that it was the same disease. As no other case has occurred there, it may be concluded the disease was not of a contagious character. It may have been parturient fever, or apoplexy, as the cow dropped a calf a few days previous.

CASES IN RUMNEY.

Sometime in April, 1879, a Mr. Kelly, then a resident of Ellsworth, some twelve miles away, lost a dog, which he had some reason to believe was intentionally poisoned. Soon after a cow appeared sick and soon died. The owner concluded, without investigation, that this animal was also poisoned, accidentally. In May, he removed to Rumney, taking with him his remaining cattle that had been in the barn and yard with the one that died. Early in June, one of these died, and a few weeks later another one. The symptoms in these instances were like those at Hampstead, and like subsequent ones in Mr. Spalding's herd. No examination was made, and no report of the cases was made to the State authorities.

One of these animals died and was buried near the pasture of Mr. Spalding, and may possibly have in some way communicated

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the disease to his herd. The first case in this herd was that of a heifer that was never in the pasture near which the Kelly cow died. She had a calf that ran with her about the yard. The heifer died, but the calf, as we understand it, was not sick. No examination. A neighbor's cow, in Mr. Spalding's pasture, was attacked and died. No examination. An ox that was used to draw away the dead cow was attacked; killed the ox and made some examination; no doctors present. Then a heifer was found dead in the pasture. A cow was taken on the 25th of July; on the 26th an ox was attacked, and on the same day a yearling bull. When these three came down, the owner, Mr. Spalding, sent for Dr. Wilkinson, a veterinary doctor of Concord, and notified the Secretary of the Board of the cases. Dr. W. made a visit to Rumney, found the cow dead, killed the bull and ox, and, aided by Dr. Darling, made an autopsy, which disclosed much inflammation of the organs of the chest and of the brain. It was the opinion of the medical men that the disease was produced by poisonous or indigestible substances taken into the stomach. *Gastritis* was suggested as a name for the disease, but at the same time it was evident that some virus had reached the brain, probably through the nasal organs. The brain and parts of the stomach and other organs were put in alcohol and sent to us for examination. They were submitted to chemical tests, but no poison could be discovered. Paris green was "indicted," but not proved guilty.

On the 17th of August, a cow which had been lingering for some days died, and an ox was sick. On the 19th, the Secretary and Dr. Wilkinson of Concord, accompanied by Drs. Adams and Emerson of Manchester (the two latter the gentlemen who made the examination at Hampstead), visited Rumney, examined the cow that had recently died, and found she had been seriously diseased, with the general *post-mortem* appearances that were found in the Hampstead cases, though more marked, and accompanied by evidences of other disease.

The ox had similar symptoms to those already mentioned; with the same wild, strange appearance of the eye, a temperature of 102.6°, and a pulse at seventy-two beats per minute. After consultation, the three doctors agreed that the animal

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could not live. The owner giving his consent, it was slaughtered and very thoroughly examined. During a portion of the examinations, Drs. Child of Bath, Tuttle of Littleton, Darling of Rumney, and Whittemore of Wentworth were present. Here, too, were found the *post-mortem* appearances heretofore shown, though in a less marked degree. The liver was badly affected. The blood tested before the animal was killed disclosed, as the doctors said, under the microscope, *bacteria* among the corpuscles, an evidence of disease.

There was a suggestion, approved by the doctors, that the disease was in some way liable to be communicated to sound animals, and at the time no one questioned its infectious character.

In view of all the circumstances, the Secretary advised Mr. Spalding to bury every portion of the dead animals, even the skin and feet, putting lime upon the carcasses before covering deep with earth. He advised isolating his cattle, keeping them away from barn and pasture where diseased cattle had been; and to disinfect his premises with carbolic acid, or other material, most thoroughly.

Just after the last case reported had been investigated, the Secretary received a note from Dr. F. S. Billings, M. V., of Boston, stating that he had been commissioned to visit the State, and investigate the diseases of cattle here. The Secretary replied, expressing his gratification at the interest Gen. LeDuc was manifesting, but at the same time suggested that as no case could then be found in the State there could be no object in making the visit at present. He also assured the doctor that he would apprise him of the first case that came to his knowledge and accompany him in his visit to make examination. The Secretary also made a similar communication to the commissioner at Washington.

Dr. Billings called on the Secretary a few days later, saying his orders were imperative and he must regard them. He spent a little time in Concord and Manchester, was put in communication with Dr. Adams and Dr. Wilkinson, and consulted with them in regard to the cases. It is hardly possible that he obtained satisfactory evidence of the real nature of the disease.

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Neither of the regular physicians, nor the veterinarian, has given in any report in writing, nor aided us in managing the matter.

There were fifteen fatal cases in the town, but none after the removal of the cattle from the infected localities, and the free use of carbolic acid.

There were cases of disease in Holderness, Fitzwilliam, Milford, and Sanbornton. That at Fitzwilliam appeared to be the foot and mouth disease, brought into the town by strange cattle sent to the mountain pastures.

AN OUTBREAK AT HAVERHILL

was reported to the Governor and Council late in the season, which was referred to a special commission, which thoroughly investigated it and submitted the accompanying

REPORT.

To His Excellency the Governor and the Honorable Council.

The special commission appointed Dec. 19, 1879, to investigate a disease in a herd of cattle at North Haverhill, represented to be the pleuro-pneumonia, have given the matter their attention, and report as follows: —

Immediately on the appointment of the commission, the chairman, on the supposition that the disease was the pleuro-pneumonia as represented, made a visit to Boston and consulted the Massachusetts officials who had had much experience in the management of the disease in that State. This was done with the view to learn the best method to arrest its spread and most speedily crush it out.

The board then met at North Haverhill, the location of the disease, and organized. Dr. Crosby, the appointed chairman, presided, and Mr. Adams was chosen secretary. The members were sworn, as the law requires, before Enoch G. Parker, justice of the peace. A visit was made to the diseased herd, belonging to Mr. James E. Merrill, whose farm is situated a mile south of the village. After a thorough examination of the premises and animals had been made, and a history of the mal-

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ady obtained, the commission adjourned to the hotel, where a consultation was held with the selectmen of the town, with reference to their duty in the matter. Much time was taken to make a careful study of the lungs of deceased animals, sections of which were sent to Boston for microscopic examination.

A young animal in an advanced stage of the disease was slaughtered, a prolonged examination made, and additional sections of affected lungs were taken and forwarded for fuller examination. The premises were carefully inspected, extended inquiries instituted with reference to the source of the disease, and the whole herd put in quarantine. Visits were made to other herds, and in one case a young animal was slaughtered; and though some cattle were found to be affected with difficult breathing or other ailment, none manifested symptoms similar to those at Mr. Merrill's barns.

A public meeting was held, in accordance with the wishes of the citizens, the case plainly and fully stated, and the course to pursue was pointed out.

The commission were not fully satisfied with the result of their inquisition, though they were confident it was a type of the pleuro-pneumonia. It might be of a malignant character, or only enzoötic, as they were inclined to believe.

Prof. James Law of Cornell University, New York, was consulted, and very kindly gave the commission valuable information regarding the lung plague, or malignant pleuro-pneumonia. The local physicians became interested in the matter, and Dr. Davis of Plymouth, Dr. W. H. H. Mason of Moultonborough, who had had much experience in treating animals, and several other members of the medical profession, lent their assistance in the case.

We arranged with Dr. Thayer of Newton, Mass., to accompany the commission in a second visit, and give us the benefit of his large experience. He was peculiarly well fitted for the duty, as he was the veterinary member of the Massachusetts commission which so effectually stamped out epizoötic pleuro-pneumouia when it appeared in the town of Belmont, Mass., and that vicinity. This investigation was very thorough and

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decisive. *Post-mortem* examinations were made, living animals were carefully and fully examined, and the premises and surroundings subjected to the most exhaustive inquiries.

The conclusion reached is given by Dr. Crosby, chairman of the commission, as follows: —

"I shall confine myself wholly to the pathology of the suspected disease, and give as clearly as possible our reasons for deciding that this outbreak was not an epizoic of contagious pleuro-pneumonia, but simple non-contagious pleuro-pneumonia complicated with catarrhal influenza, induced perhaps partly by atmospheric changes and partly by local causes. To understand the condition of the lung after death, in pleuro-pneumonia, whether contagious or non-contagious, it is necessary to know something of the lung in its normal state. With regard to the substance of true lung tissue there are some peculiarities which deserve especial note, as they distinguish the lung of the ox from that of most other animals. In the bovine tribe a state of affairs exists through adult life, which is found only in the early stages of growth in the lung of man. It is of course understood that each lung is composed of lobes divided by fissures, and each lobe is divided into lobules also separated from each other, as will be seen farther on. The lobes contain the bronchial or breathing tubes, the blood-vessels and the tissue which binds them together, while each lobule has leading into it a small bronchial tube the one hundred and twentieth to the one seventy-fifth of an inch in diameter, which breaks into branches, each one ending in an elongated cell called an air-cell. The walls of the cells are largely made up of thread-like blood-vessels forming a network. This thin membrane, when moist, allows the passage of oxygen and other gases, and here the blood is brought to be purified of its poisonous carbonic acid gas, and to receive the oxygen which purifies and restores its color. Now in the ox the connection between the lobules can be stretched by gentle traction so as to make the partitions between them an eighth of an inch in width. A little more force applied, aided by the knife, tears through this delicate network, so that the lobules may be completely separated from each other. They are thus left hanging from a large bronchial tube by many

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of their own fibers, as raisins hang from the parent stem. In the lung of the healthy ox these lines or inter-spaces between the lobules are easily seen by the naked eye, but their color is a silvery white, and they can often be traced by little chains of air bubbles. It is very essential that these lines of division be understood, as upon their size and color depends our knowledge of the difference between contagious or *epi*-zoic pleuro-pneumonia and the non-contagious or *en*-zoic form of the disease. There are very few diseases in which the appearances after death are more characteristic than in pleuro-pneumonia So distinct are the characters of the late stages of this disease that the most unscientific eye can recognize it after having seen it once or twice. The morbid changes themselves are very constant, and there is besides a general character which is so peculiar as to be easily recognized in any stage of the disease, and which is deemed a safe ground for the opinion of the veterinary surgeon. Morbid changes occur in the pleura, or covering of the lung, in the lung substance itself, and in the bronchial tubes or blood-vessels. As the name pleuro-pneumonia implies, the inflammation of the pleura is a very constant factor in this disease. It is so marked that it can never be overlooked upon a *post-mortem* examination, and any acute ear can detect its existence during life by the sound produced by the rubbing of the membrane against the chest walls. Exceptions to this rule happen occasionally in fat cattle where the lung is plugged and the pleura healthy. When there is well-marked pleurisy discovered in an animal, it is the first symptom of the disease. The disease is often confined to one lung, — the right more frequently than the left, — but is also found in both, but not in equal degree. Although the lungs of an ox may become so solidified as to weigh nearly one hundred pounds, still a considerable portion of the organ will admit air. Unlike the solid condition found in the lung of man dying from pneumonia, the lung of the ox swells considerably, but unevenly, this forming one strong proof of the presence of the disease. Upon cutting into such a lung a network of yellow lines is seen covering the freshly-cut surface, about one-eighth of an inch in diameter and dividing the surface into figures of many sides — each figure or polygon being

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about one-half or two-thirds of an inch in diameter. These figures are simple sections of the lobules, and the yellow lines are the swollen inter-lobular spaces cut across. These pale yellow streaks crossing the surface of the lung in many directions resemble the whitish veins running through variegated marble, and hence the common name of *marbling* has been applied to this appearance by veterinarians everywhere. Now this marbling is admitted to be the one great decisive appearance of *contagious* pleuro-pneumonia. It is sufficient to say here that in all the autopsies made by and under the direction of your commission, no such appearance has been found in any of the animals which died or were slaughtered. I have already stated that in this disease the pleura may escape altogether, and the disease be confined to the lung substance and the lining of the air or 'bronchial' tubes which ramify every portion of the lung. Indeed, the best authorities assert that the disease usually begins in the tubes in the form of a chronic inflammation. The smaller tubes seem to take on the disease first, and thence it spreads by progressive inflammation to the adjacent tubes, and finally to the connective tissue.

"The logical inference from this fact seems to be that epizoic pleuro-pneumonia being a local disease starting in the lining membrane of the bronchial tubes, it can only be produced by direct and immediate infection of that membrane. Dr. Teo of London, who first published these views, also states 'that it is little to be wondered at that inoculation of the tail cannot produce the local disease in the lung, though it may and does set up an inflammation which runs a course not unlike that of the lesion in the lung.' He asserts that when he has inoculated a tail successfully the tissues under the skin undergo a change exactly like that between the lobules of the lung, and the infection spreads rapidly by the lymphatics. This enables us to understand how a beast sniffing the fodder of a diseased neighbor may draw into the air-passages some of the dried discharge, and thus infect the mucous membrane lining its nose and air-passages, and get pleuro-pneumonia, while no amount of inoculation with matter from a diseased lung will induce the local disease. Thus inoculation has failed to palliate this epizoic, and no

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remedy has been suggested that will cure it. It is a chronic, specific, local disease, highly contagious and very fatal; and the experience of Great Britain, in its futile attempts to stamp out the scourge, should warn us that a genuine outbreak of the disease should be met by the most vigorous measures. Strict isolation until the disease is developed, and then the ax. It cost the State of Massachusetts seventy-five thousand dollars to eradicate it there, and the work was done cheaply — for within the past year over half a million of dollars has been expended for this purpose in England, and the end is not yet."

It will be seen that much labor and study were given to the investigation, and the best professional talent employed to determine the nature of the disease.

The commission may not have been fully successful in accomplishing the work to which they were called. They were for a time unable to determine the character of the disease, and found it especially difficult to reach it by efficient remedies. That it was pleuro-pneumonia was evident from the first, but the commission never entertained a belief that it was of the contagious form, though there were attending circumstances that at first pointed in that direction.

They were unable to trace the disease to a satisfactory and positive source. It was alleged by certain parties that negligence was the cause of it. But reliable testimony convinced us that at least ordinary care had been exercised. It was also conjectured that the disease was introduced by a strange drove that was harbored on the premises some weeks previous to the appearance of the disease. A full investigation in that direction compelled us to seek other cause. It was freely asserted by citizens that it was induced by malarial influences, and that a section of unreclaimed land was the bed of the infection. The commission could see no foundation for such a belief.

Dr. C. P. Lyman of New York, an eimnent veterinary surgeon, was sent by the Department of Agriculture at Washington to investigate the matter.

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DR. LYMAN'S REPORT.

On my arrival in New York I visited Dr. Liautard, from whom I learned that the disease still prevailed to some extent in Eastern New York and on Long Island, and that there was a reported outbreak at Haverhill, N. H. The New Hampshire State commission had pronounced this outbreak as of a sporadic character, yet the circumstances attending it were of a suspicious nature, at least, sufficiently so as to throw doubt on the decision arrived at by the State commission, and I regarded a further investigation necessary in order to positively determine the matter.

I arrived in Boston on the 3d day of February, where I met Dr. Thayer, a member of the Massachusetts commission for the suppression of contagious diseases of cattle. He had made some investigations of the New Hampshire outbreak, and gave it as his opinion that the disease prevailing there was not contagious. However, he did not regard his *post-mortem* examinations as satisfactory, as he was in no case furnished with whole lungs. I also saw Dr. Billings here, who informed me that he had examined portions of the diseased lungs of some of the affected cattle at Haverhill, N. H., and from the appearance he did not regard the disease as that of contagious pleuro-pneumonia. He did not regard his examination as satisfactory, however.

I left Boston on the 5th day of February for Concord, N. H., for the purpose of seeing Dr. A. H. Crosby, chairman of the State commission. He regarded the Haverhill outbreak as of a suspicious character, and advised me to visit that place at once and thoroughly examine the affected herd. He gave me an order for the slaughter of such animals as I might deem necessary for examination, and also a letter to the chairman of the board of selectmen for the town.

I arrived in Haverhill on the morning of the 6th, and in company with Mr. Parker [chairman of the selectmen] at once proceeded to the farm of Mr. Merrill, the owner of the suspected herd. I found the animals suffering in various degrees from respiratory troubles. As the herd was supposed to have been infected by a drove of cattle from Canada, I asked Mr. M. when this drove stopped with him. He answered : —

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"On the 11th day of September; the first case of sickness occurred about October 26; the animal died on the 2d of November, having been sick only about one week."

Which was the second animal attacked, and when?

"The light-colored or Fisher cow. She was taken somewhere between the 7th and 14th days of November. The calves first showed symptoms of sickness about the 14th of November. They were taken sick one by one with an interval of about seven days between each, except in one instance, when two were attacked at the same time."

Mr. Merrill described the symptoms as follows: —

"Coughing is the first symptom. The nose is dry; and the animal stands with its back arched and elbows turned out. If forced to move briskly about it will cough and pant. The disease seems more severe during a thaw than when the weather is colder. There is some running from the eyes. The appetite is invariably good up to about twenty-four hours before death. From six to twenty-four hours before death occurs, the animal is not able to stand. As death approaches, the animal groans quite loudly; the breathing becomes accelerated, and the cough seems to come from a more or less solid body. In coughing, a calf will extend its nose on a level with its neck. This symptom has not been observed to so great an extent among the cows."

How many cows, calves, and yearlings did you have in the fall? How many of each have been sick, and how many have died?

"In the fall I tied up the following-named animals: —

Cows	11 head.	Sick, 4 head.	Died, 1 head.
Calves	23 head.	Sick, 10 head.	Died, 6 head.
Yearlings	13 head.	Sick, 3 head.	Died, 0 head.
Total	47	17	7

How have these animals been housed, and how have they been fed?

"The cows and yearlings were tied up on the same side of the

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barn in a long row, but the yearlings were kept at the further end of the building by themselves. The calves have all been kept together in a separate pen 18 × 12 × 7 feet. During the day they were all turned out into the barn-yard. The cows have been fed on roots and hay, the yearlings on hay alone, and the calves on hay and roots."

Mr. M. continued: —

"The cows from this strange herd were put into the barn-yard, and the calves into a little pasture adjoining. About a week after this herd left, my own calves broke into this pasture. That would make the date about the 18th of September. October 20th I brought home a drove of calves myself from the north, and the first calves taken sick were some of these driven calves."

This being the statement, I regarded a *post-mortem* examination necessary in order to settle the question as to whether this outbreak was occasioned by contagious pleuro-pneumonia. For this purpose I thought it best to take the "Fisher," or light-colored cow, as she was the first attacked and had been the sickest animal of the lot. She was, therefore, slaughtered. I found the lungs in a *perfectly healthy condition*. The pleura of the ribs still showed plain traces of previous inflammation, but she had so far regained her health as to commence to again lay on healthy fat. This cow *never* had contagious pleuro-pneumonia.

I found a calf quite sick, evidently in an almost dying condition. This was next killed, and an examination revealed the fact that it had been suffering from a clear and unmistakable attack of bronchitis. This I demonstrated to the satisfaction of the medical representative of the New Hampshire commission, Dr. Watson. There had been preserved a pair of lungs taken from a calf which had died a few days previously. These showed the lesions of sporadic pneumonia, with some bronchitis. All the specimens were sent to New York for the inspection of the profession.

In looking about for the cause of this outbreak, the buildings and the lay of the land in the immediate vicinity of the premises were thoroughly examined. The homestead is a meadow farm, lies well, and is inclosed by small hills, with a brook run-

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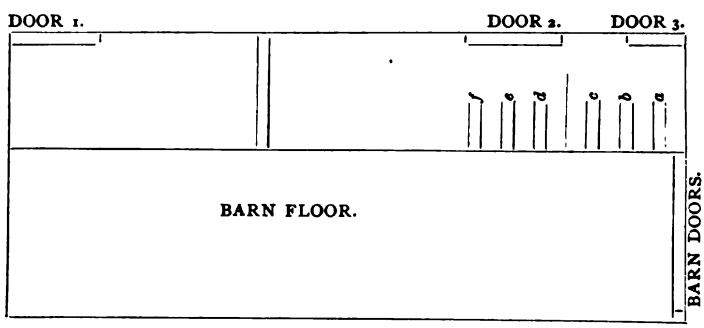
ning a crooked course near to the buildings — a place that, in the fall of the year, would retain the fogs rising from the water for a considerable length of time. Further investigation proved this theory correct.

The calves, when removed from the meadow, where one or two of them had taken cold, were, about the 10th of November, put into a close shed, eighteen feet long, twelve feet wide, and seven feet high. Here they were tied up in two rows, and were so close together that they completely packed the pen. This huddled condition, to my mind, furnished ample cause for the outbreak, for I do not think that a pen of such dimensions, with so many animals confined in it, could be sufficiently ventilated to preserve health in the absence of mechanical means. I advised the erection of another pen and a division of the herd.

I found that the cows had caught cold from being constantly subjected to a draught of cold air, so applied as to keep their bodies constantly bathed in a cold current. The arrangement of the barn is given in the following diagram: —



The yearlings were turned in through door No. 1, and divided from the cows by a partition. This door was then closed, and they were left to themselves. The cows were turned in at door No. 2, which, together with the large barn-door, was open a considerable portion of the time. Door No. 3 was seldom used. Between the cows and the barn-floor was a board partition, with the board at the bottom *fixed to lift up*, thus leaving an open space fifteen inches wide directly in front of the cows and down at the floor. Except in *very* cold weather, this novel ventilating

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device was left open all the time. The air rushed in through the wide, open door and the opening in front of the cows, passing over and bathing their bodies, and especially the under part of their breasts, chests, and abdomens, on its way out at door No. 2, which, by the way, is a little larger than any of the doors on this side. This cause I regarded as sufficient to give the toughest animal a cold.

In order to prove this theory correct, it is only necessary to state the following facts: Cow *a* in the diagram, a small and nearly black one, stood in the corner against the partition, *just* out of the line of draught, *and has never even coughed.* Cow *b* was the first animal taken sick, and the only one that died. Cow *c* was sick, but not so bad as either cows *b* or *e*. Being next the partition, even if on the cold side of it, may account for this in a measure. Cow *d* had been but very little troubled. She coughed slightly, but nothing more; the partition may have protected her. Cow *e*, the light-colored or Fisher cow, was the second * one taken sick, and was more seriously affected than any of the others except the one that died. Of the four animals which were called sick, although the whole herd except cow *a* were more or less affected with coughs, cow *f* came third. The yearlings were turned in and tied up without any regard to regularity or place. Several of them coughed. Three of them were sick, i. e., the respiration was considerably accelerated, but none of them died. It was advised to close up the feeding space next the floor and put it up in the partition three and one-half or four feet from the floor, so that the draught through would be over the heads of the cattle.

It may be objected that this cause has been in operation for years, and no such trouble has before occurred. The only answer to this objection is, that the past season has been remarkable for its sudden changes. I am told that it has not been uncommon here for the thermometer to vary from 30° to 40° in the course of twenty-four hours. These sudden changes are as liable to affect cattle as human beings, and where exposed as these were, without artificial covering, they could hardly be expected to remain exempt from serious colds. Another thing

* It is stated on a preceding page that this cow was the *first* attacked.

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should be remembered: the past winter has been so mild that attendants no doubt became more careless than usual, and often neglected to close the doors and feeding-troughs.

It appears from Dr. Lyman's report that he accepts the theory of malaria, fogs, inadequate ventilation, draughts of air, etc. The commission had previously decided that the ventilation of the calf-pen was not sufficient for so many animals, and were satisfied that much was due to local influences, but not to malaria from reclaimed meadows, nor to the fogs, which are not of unusual duration, nor do the commission believe in the cold draughts from the large doors on the breasts of the cattle, for the owner and his men assured us that not once during the whole season were these doors opened when the cows were in the stable. The diagram given above does not represent the position of the floor and the tie-up. If the diagram were reversed so as to bring the upper right-hand corner to the place occupied by the lower left-hand corner, thus bringing the yard and doors, the floor and tie-up, directly the reverse of their present position, it would give us a correct idea of the barn. With these exceptions, we do not take issue with Dr. Lyman. A combination of causes, as suggested in the statement of our chairman, and a majority of those named by Dr. Lyman, — exposure to severe storms, the immediate change to very warm, somewhat limited quarters, that were not perfectly ventilated, the loss of exercise, — all evidently had a tendency to cause irritation of the throat and lungs.

That the disease was a serious one to the owner is very evident; for nearly every one in the yard or barn suffered more or less; eleven died or were slaughtered; those that lived, suffered loss of flesh and strength which they did not readily recover.

The loss to Mr. Merrill was very nearly equal to a loss of his whole stock of nearly fifty animals, some of which were superior butter cows and promising young animals. Not only did he lose their use or growth, but they consumed his hay and grain, required his own personal attention, and subjected him to great expense for assistance and medicinal preparations. Worse

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even than this; cows that did not die, aborted or dropped mature calves that proved to be affected by the same disease.

Now that the commission has done all it has been able to do, there seems to be a few suggestions necessary for the benefit of the immediate sufferer and for the public.

The expense to which Mr. Merrill has been subjected and the loss he has sustained should be repaid or made up, at least in part. The commission present the facts to your body and leave the determination of the matter to you.

The law provides that the selectmen for the town shall meet the expense as ordered by the commission, but it does not specify the manner in which the statute shall be enforced. We have notified the town authorities of the legal requirements, but have not felt authorized to make a demand on them to compensate Mr. Merrill.

Another question for consideration is as to the future. Shall we expect to find a return of the disease, the coming winter, as a consequence of its existence on these premises? We do not entertain the idea that it is contagious. We saw no danger in sending the remnant of the herd to pasture, and therefore released them from quarantine, and allowed the owner to exercise full control over them. No ill result came from it. But may there not be such an infection in these barns and yards as will endanger another herd, when brought in from the pastures? If so, what is the duty of the State? These are matters over which this commission has no control, but which should have the most careful consideration of the State through some legally appointed agency.

Respectfully submitted.

A. H. CROSBY,
JAMES O. ADAMS,
Special Commission on Disease of Cattle at North Haverhill.

CONCORD. Oct. 10, 1880.

Following will be found valuable papers on diseases of domestic animals, by Dr. Mason of our Board, Dr. Law of Cornell University, and Dr. Detmers of Chicago. The specialties here

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discussed interest our people, though the diseases are not productive of serious loss. We have had no pleuro-pneumonia of a virulent type, no disease among swine, two or three lots being the only destructive cases, and only rare instances of that filthy and dangerous disease known as glanders.

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SPECIFIC DISEASES OF ANIMALS.

BY DR. W. H. H. MASON, OF MOULTONBOROUGH.

PLEURO-PNEUMONIA is the most mysterious, insidious, and most deceptive in its inception and development of all bovine diseases. It is both infectious and contagious, and, like small-pox in the class *homo*, is influenced by inoculation. It was known in Europe as far back as 1769, under the general name of "murrain." It has also been known in later time as "pulmonary murrain," in contradistinction of other forms of murrain. I will say here, in brief, that murrain is a popular term applied in time past to all malignant cattle-diseases, and has no significance except to indicate a frightful fatality.

This disease has also been known as the "lung plague," — a term far more expressive of the nature of the disease than pleuro-pneumonia. The true rendering of "pleuro-pneumonia" is inflammation of the lungs and their membranous covering, and is applied to a disease in the human family. It is not considered malignant, whereas the term "lung plague" expresses at once the alarming nature of the disease. Doubtless the disease extended farther back than the time above named. Aristotle wrote, three hundred and fifty years before Christ, in his "History of Animals," "The cattle which live in herds are subject to a malady during which the breathing becomes hot and frequent. They die rapidly, and the lungs are found spoiled." We may at least suppose that the disease so quaintly described by Aristotle was the same as that of which we are now speaking.

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The first notice of this lung plague (for I choose thus to call it) in this country was in 1843, on Long Island. It was brought from Germany in a cow transported for breeding improvement, since which time we have not been free from it, though through judicious legislation and proper sanitary care it has been well controlled.

In 1857 Mr. Thomas Richardson imported some blooded English stock into New Jersey, for which he paid fabulous, and, as in other similar cases, very unreasonable prices. Soon after the importation he discovered this disease among them. Knowing the consequences of neglect in these cases, he promptly caused ten thousand dollars' worth of these and his other stock to be slaughtered. This, though severe, was the only preventive to its prevalence; it included his whole stock.

In 1859 it was introduced into Belmont, Mass., in a herd imported from Europe by Mr. W. W. Chenery. Taking into account the great losses from imported diseased stock, it is very doubtful if the importation of what is called blooded stock has been, or will be, any profit to the country.

Unlike other diseases, the animal sometimes not only retains its wonted flesh, but appears to increase in flesh, even while going on to a fatal termination, and while supplying virus for the infection of others of the herd.

The premonitory symptoms are chills, dry cough, increased respiration, staring of eyes, and rigid skin; the excrement of bowels is dry, and urine scanty. The animal heat soon rises to 104.5°, or one and a half degrees higher than fever heat in man. A pathognomonic sign of the disease is a peculiar grunt when the spine or side is pressed.

Auscultation detects in the early stages a harsh crepitus produced by the inspiration of air through the bronchea.

One or both lungs are in a high state of inflammation, sometimes one, sometimes the other, constituting single pneumonia, and sometimes both, called double pneumonia; this last constitutes a formidable form, and is fatal. The organic lesions are confined to the lungs, pleura, and heart. Its duration averages about forty days, sometimes less, sometimes more. It is a dis-

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ease *sui generis*, and is always produced by infection or contagion.

For some days after the premonitory symptoms commence, the animal seems to thrive unusually well, and this is a source of delusion, and delays treatment. It has been mistaken for increase of fat, and probably is owing to an œdematous condition of the animal.

The whole appearance indicates great pain, manifested by these peculiar guttural sounds or grunts. No doubt the pain is located in the side, and is the same as pleurisy in man, — the intensity of which every one knows who has ever experienced it. As the disease advances the pulse rises to seventy or eighty per minute, the natural beat being about forty.

There is a watery discharge from the nose, while the muzzle is dry. Any one acquainted with the disease will readily recognize it by a characteristic position. The animals stand fixed in one position, from which the most persistent effort may fail to move them. This is probably produced by an increase of the pleuritic pain which occurs upon the slightest motion, and this resistance to motion is caused more by the increase of the pain than by any pathognomonic indication of this peculiar malady. It is further characterized by the pressing of the head forward, the back arched, the fore legs extended, and knees turned outwards. They invariably lie down on the affected side.

The termination of the disease of course is restoration or death. A steady increase in the severity of the above symptoms denotes a fatal termination; while the reverse may give some assurance of recovery, though this is not entirely reliable, for sometimes these delusive symptoms occur while the lungs are taking on gangrene. In such cases the change for worse is sudden and unexpected. I say "unexpected," unless you have acquired some knowledge of auscultation, when you may detect the unfavorable changes going on in the lungs during these outward favorable indications.

Sometimes death occurs very early and is preceded by a very high fever. This is frequently caused by embolism of the heart.

Usually the disease becomes chronic after twenty-one days; after forty days the animal either becomes immediately conva-

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lescent, or the disease has a protracted fatal course, lasting sometimes three months.

This epizoötic, like epidemics, does not always take the same type. Sometimes it takes a mild form, ninety-nine per cent recovering; sometimes it takes a malignant form, ninety-nine per cent proving fatal.

The fatality of this frightful disease is so great as to impose a loss of ten million dollars on England and Ireland alone in twenty-five years. Fortunately, it existed for a sufficient length of time in the old countries for us to become acquainted with its nature and the proper preventives, so that its introduction to the United States has been met promptly, and every appliance used to check it; so that the losses, though great, do not compare with those of other countries. To be suppressed it must be promptly met and dealt with. The great danger consists in the mild form of the disease, which is so mild sometimes as not to attract notice, so mild that the attention of the owner is not called to the creature at all, and the only evidence of its existence is the old adhesions found in the chest of the animal after being slaughtered.

From these mild cases the most malignant form may be propagated, so that a community is more likely to suffer from mild than severe cases.

There is an interesting query connected with the disease; that is, whence its origin? Epidemics and epizoötics occur from spontaneity. Not so with this infection and contagion, and I should prefer to class it under these two significant terms than that of epizoötic. Impure water of swamps, malaria, miasma, overwork, location, altitude, condensed or rarefied atmosphere, will not engender it, nor will anything, save infection or contagion.

Like small-pox, it must have existed for a long period of time; how long, or how it came, nobody knows. Another interesting inquiry is whether it is specific; that is, whether one attack assures immunity from a future exposure. It probably does, as do specifics in the human family.

There is a disease which has proved very destructive to cattle in this country, called the "splenic fever." It is also known as the "Texas plague." It is not likely to prevail in the Northern

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States, proper care being used. It is enzoötic, and only comes to us through the transportation of Southern cattle — Texas cattle — to our markets. The facilities of transportation now are such that every edible, from the products of the vine to the herd, finds a quick market in all the cities of the States. Large numbers of Texas cattle are sent to New York, Boston, and even to Manchester of this State. Not a little alarm was produced in Manchester a few years ago by the discovery that some of these diseased cattle were being thrown upon the market. It is claimed that the flesh or milk of animals infected with splenic fever is not poisonous or hurtful; but such assertions do not inspire us with sufficient confidence as to create a hankering after that kind of flesh, and a person knowingly distributing such for food should suffer the full penalty of the law. It is certain that calves do not take the disease or become sickened by subsisting upon the milk of diseased cows.

The disease is not contagious or infectious, in the common acceptation of the terms, though it properly may be classed among the infectious diseases. It does not prevail as epizoötic; there is nothing in common or like other cattle plagues. Coming in contact with the disease does not produce it, nor does the inhaling the breath; neither can it be produced by inoculation. The virus lies exclusively in the excrement, and is communicated to other cattle which by chance swallow this excrement. It is, in fact, a poison. If healthy cattle herd with those diseased in pastures, or follow them in the highway, there is great probability of their taking the excrement dropped upon the grass into their stomachs. Thus you see that by proper care we may have no fears in New Hampshire; still it is quite necessary that we should become acquainted with its very peculiar nature in order to avoid it.

Although called the "Texas plague," it is not confined to that State. It is an enzoötic of all the Southern States, extending as far north as Kansas. The name may perhaps arise from the fact that the cattle transported north from that latitude come mostly from Texas. The proper name is "splenic fever." The seat of the disease is in the spleen. This organ is in a high inflammation.

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It is claimed by some that there is a pathognomonic indication of this disease in the presence of a peculiar tick; but this has been successfully contradicted. Many cases have been noticed entirely free from this parasite, and, also, it is a well-established fact that the malignancy of the disease does not depend upon the number of these ticks. Nevertheless, it is beyond all doubt true that in a very large percentage of the cases there does exist a tick (*Ixodes indentatus*). This parasite is about the size of the sheep-tick; has eight legs, with indentations upon the sides by which it is classified. This disease has a very brief course, reaching in three or four days a fatal termination. The symptoms, in brief, are drooping ears, depressed head, arched back, trembling of muscles, a tendency to draw the hind legs forward, skin dry and hot. The initiatory symptoms are very much as other febrile diseases. As the disease advances, there is a tendency to lie down, and, if possible, in a pool of water. Pulse, from sixty to one hundred. It seems to affect the hind limbs, the muscles of which have a spasmodic tremor. Animals die with the symptoms of morbific poison, which it undoubtedly is.

The treatment is of no account to us, and amounts to but little where it prevails.

There is now a very interesting investigation going on among scientists as to the origin of this as well as other epizoötic and enzoötic diseases. Through very delicate and carefully handled optical instruments, a fungoid, vegetable in its nature, has been discovered in the blood and gall of diseased animals, as well as in some of the diseases of the human family, called "cryptogamia." There may seem to be too much science to this, more science than sense; yet it is certainly a very laudable investigation, and may be the fortunate means of a great advance in the discoveries as to the ultimate or origin of these diseases.

Man has a safe immunity from the most of the diseases of animals, especially epizoöty, so that the alarm or losses consist in dollars and cents. There are a few, however, that are communicated to mankind, and consequently give great reason for alarm. I shall speak of only a few at this time.

Trichiniasis is a disease of very recent discovery, although there can be no doubt it actually existed for an indefinite time,

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or back to the time when the law prohibited the eating of pork. We are indebted to the microscope for its discovery, without which we should now be as ignorant of this disease as were those who lived prior to the application of this useful instrument in the diagnosis of diseases. Many have undoubtedly fallen victims to this malady under some mistaken name. Prof. Zenker of Dresden has the honor of first discovering its nature and cause.

A young girl had a protracted illness of great severity, attended with debility, fever, extreme restlessness, irritation, and diarrhea, with great pain and uneasiness in the flesh. He learned that the patient had eaten of ham and sausages, and upon a microscopical examination he discovered parasites called *trichina spiralis*, both in the food and the muscles of the patient. Soon after the publication of this case, which was in 1860, numerous other cases were reported from other places, and finally in our own country. Probably many of you recollect the excitement that prevailed among pork-eaters, following the publication of these cases. *Trichina spiralis* is a parasitic worm with a spiral tail (or extremity resembling a tail). The worm is about one thirty-sixth of an inch long, and one six-hundredth of an incht hick. They are abundant in mice, especially the field-mice, and are supposed to be communicated to the hog through feeding upon these animals; consequently swine running in woods and pastures will be more likely to be possessed of the trichina. And this fact may account for its prevalence in the Western States.

The peculiarity of this worm is that it does not stay in the cavities, but immediately upon being hatched, or rather quickened, in the stomach, commences a tour of the system by perforating the solid tissues, and finally lodging in the muscles. When once in the muscles they become quiet and motionless, and soon become encased in a covering, first soft or gelatinous, then hard or calcareous. At this stage the irritation ceases, and if there has been sufficient stamina of the system to withstand the irritation of this exodus, the patient recovers; otherwise he dies. In this state they remain indefinitely, even for years; or, if in animals of food, until they are taken into the

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stomach and the encasement dissolved by the action of the fluids of the stomach, when they are set free and commence to increase in great numbers, their progeny repeating the journey of their progenitors. To fully appreciate the vast irritability caused by the transit of these parasites, you have only to know that as many as two hundred thousand exist in the cubic inch.

The source of this affection frequently comes from sausages and hams imported from trichinal countries, and from taking them into the stomach in a raw state. Thorough cooking destroys them, so that if any one has suspicions of the existence of these parasites, he has only to subject his food to a high degree of heat, though the idea of two hundred thousand of these pests to every cubic inch of food is not at all inspiring to a delicate stomach. The treatment consists in allaying the irritability by opiates, and keeping up the strength by stimulants and tonics until the lodgment of the parasites.

There are other parasitical diseases among swine more loathsome than that of trichiniasis. Some of the supposed epizootics among swine in this country, such as hog-cholera, hog-fever, have been traced to parasitical worms as the cause, both in the cavities and solids of the animal.

One, the lung worm (*strongylus elongatus*), lies in the mucous membrane of the bronchea, the air-tubes, causing great irritation and inflammation. The pig dies, and his case is pronounced hog-cholera or hog-fever or some other misnomer that an ignorant diagnosis may have applied to it. This worm deposits its eggs in the mucous membrane, from which, through paroxysms of coughing, they are thrown out into other fluids, where they hatch and are ready to be taken into the stomachs or air-passages of other swine wallowing and rooting in the same mire. When many hogs herd together these parasites become so numerous as to infect to such an extent as to take the form of an epizoöty; hence the miscalledcholera or fever.

There is another species known as the "lard worm" (*stephanurus dentatus*). This also produces symptoms mistaken for hog-cholera or hog-plague. The liver is the lodging-place of this worm, causing inflammation and disorganization of that gland.

Hydatids are found both in the cavities and solids of the pig.

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There is hardly an organ in the pig that is not liable to some kind of parasitic worm. He is a filthy animal, not at all particular as to his food. Probably his filthy habits are the causes of the most of these disgusting diseases.

It is thought by many eminent writers that scrofula in man had its origin in the cutaneous diseases of the pig. Tubercles exist both in man and in swine. This is a small, cheesy substance, from the size of a millet-seed to that of a pea, diffused through the lungs and sometimes in other organs. Pulmonary consumption is the result of these deposits. It lies dormant for a long time, sometimes for years, and sometimes is never developed in its ulcerative stage. For this reason we do not see consumption in the hog, as he is slaughtered before the ulceration of the tubercles. Nevertheless they are eaten with the flesh of the animal. I would not say that the assimilation of tuberculous pork in the human system will always or often produce as a consequence tubercles in man, but it must be patent to any one that food of this kind might be one of the causes, especially in the predisposed. Perhaps here you would inquire, under these circumstances and facts, Is pork a proper article of diet? It was prohibited by the Jews wholly for sanitary reasons, and I think that scrofula and consumption would be far more readily developed under its use than otherwise.

Rabies is a still more alarming affection, as it invariably has a fatal termination. This disease is more commonly known as "hydrophobia," signifying a "dread of water." It is a misnomer entirely for the disease in the dog, for he seeks for water and will lie down in it, to cool his raging fever. He will lap it greedily, though there is a spasmodic action of the glottis rendering it difficult to swallow. Many have the erroneous impression that if the dog will cross a stream or approach a puddle of water without a spasm, he is free from the disease. Not so with man; he has spasms of the throat at the sight or sound of water, but not until he has made several ineffectual attempts to swallow it, and in his case it is not the sight or sound of water, but the remembrance of the unendurable pain in previous attempts to swallow. So that while "rabies" is the more proper name for the disease in the dog, that of "hydrophobia" is the more proper

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in man. While its terrible fatality forces itself upon our minds, there is a relief in the fact that but a small percentage of cases reported are the genuine hydrophobia. Many believe that no such disease exists, and have written ingenious essays to sustain their position. They claim that the symptoms are produced through fear and frightful apprehensions. There is no doubt, however, that such a disease does exist, for children who have no apprehensions or fears have had it, following the bite of a rabid animal. It would be very difficult for a person of delicate nervous sensibility, having supposed himself bitten by a rabid animal, and possessing a knowledge of all the horrors of the affection, to determine himself sufficiently as to escape the symptoms he has been taught to expect; and many deaths occur under these circumstances. It is well for people to know that not one-fourth of those bitten by a rabid animal have the disease, and probably not one-fourth of this number would have had it had they never heard of such a poison. When the bite occurs through the clothing, the poison is almost sure to be wiped from the poisonous teeth before they enter the flesh.

This affection is always the result of inoculation of the poison in man, though it does occur spontaneously in beasts, especially in the wolf, the bite of which is very much more likely to infect than that from the dog. It cannot be produced by rubbing the poison upon the skin or swallowing it, unless it in so doing comes in contact with a raw surface. After the bite the wound usually heals, leaving a scar, and a period of incubation occurs, varying from two weeks to three months, and as time recedes from these periods the disease is in the same ratio unlikely to follow, unless, as intimated, through fear or apprehension. The duration of the disease is from two to five days, and when the symptoms continue beyond the fifth day we are justified in giving it some other name than hydrophobia. Before the characteristic symptoms set in there is usually a change in the scar of the wound. It becomes red, irritable, and sometimes festers, as in the vaccination for kine-pox. In this there is a period of incubation, and the point of vaccination begins to pustulate before the general symptoms occur. It is supposed by some that the virus lies in the wound during its incubative state, and that the

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proper treatment is to excise the whole scar before the inductive stage commences. This is certainly the course I should pursue had I a case of the kind to treat. I refrain from giving the symptoms, as it would be of no practical benefit, or the treatment, as everything has thus far proved a failure. I would advise, in case that any one should unfortunately be bitten by a mad dog, that the animal be restrained but not slain, until you have assurance whether he is rabid or otherwise, for this may be the means of removing all apprehensions, and consequently all danger, from the disease, either real or imaginary.

A very erroneous and vulgar impression prevails in the minds of many that rabies is not only communicated to mankind from the dog, but with it are transmitted certain canine characteristics, such as barking, biting, attempting to go on four legs, etc. We even see cases reported in our journals vividly portraying all these canine habits or traits. The poor sufferer, during spasmodic paroxysms of the glottis in his vain attempts to free his throat of mucus, emits a peculiar sound, caused by the constriction of the throat, that by the credulous might be imagined as resembling the bark of a dog; but this disease is sometimes taken from the bite of the cat, then of course we should expect to hear the patient mew; but this comparison would not be thought of, did not the bystander suppose he was witnessing a case of rabies. In his great agony, the sufferer throws himself forward over the side of the bed, which, under the same circumstances as the other, gives the impression of an effort to run like the dog. As to the attempt to bite, it has no foundation in truth, and is supremely ridiculous; if such occurs, it is accidental and free from danger as would be a bite from any highly excited animal.

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THE GREATEST DANGER TO OUR STOCK.

BY DR. JAMES LAW, IN THE "LIVE-STOCK JOURNAL."

THE "Journal" has frequently called attention to the great dangers that beset our live stock from imported plagues of foreign origin. During the past year the sudden invasion of Western Europe and England by the rinderpest roused the agricultural community from their dream of safety, and called forth from the treasury an order remarkable alike for its promptitude and good intentions, and for the fatal blunders which rendered it worse than a dead letter. Once more there seems a prospect of a renewal of these apprehensions, the Russo-Turkish war having led to an extension of this cattle plague into Hungary, from which the Atlantic coast and Great Britain may be any day infected, owing to the activity of the stock trade. Should this unfortunately take place, it will find us no better prepared than we were a year ago, and our treasury order, now in force, will freely invite the disease to enter, provided it makes its advent respectably — in the systems of *blooded stock*, and not in poor cross-bred animals, which it would be ruinous to import, even if sound. A similar welcome is extended, by implication, to all those ruminants which are devoted more particularly to luxury, and have not been degraded to such vulgar utilitarian objects as the production of meat or wool. Yet all ruminants are subject to rinderpest, and this malady was carried to France, in 1866, by two gazelles, as other plagues have often been carried to new countries by the privileged *blooded stock*.

But we started out to notice a danger which is no longer sep-

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arated from us by the broad barrier of the Atlantic, and whose malign presence is not to be dismissed by any one of ten thousand contingencies, as is the case with the possible advent of the rinderpest. This danger stands in our midst, and is steadily gaining in force as it encroaches farther and farther, showing how certain it is, if unchecked, to lay the whole country under contribution, and inflict most disastrous and permanent losses. The lung fever of cattle, imported into Brooklyn, L. I., for the first time, in 1843, in a Dutch cow, has never since been at any time entirely absent from our soil. From this center it has slowly and irregularly extended over a portion of New York, New Jersey, Pennsylvania, Maryland, Delaware, and Virginia, besides having repeatedly invaded Connecticut. The slowness of its extension has begotten a false sense of security, and no real apprehensions of serious consequences remain from an animal poison which has been for over a third of a century hidden away in the near vicinity of the Atlantic coast.

To disturb this comfortable and restful condition of the public mind is an unpleasant task, which nothing but the imperative sense of duty would compel us to undertake. But this disease has a history, which we can only ignore at our peril; and as its records can now be drawn from all quarters of the globe, we can have before us an unequivocal testimony as to what will inevitably happen under given conditions of climate, surroundings, and treatment.

England imported the lung fever of cattle in 1842, just one year before we did, was soon very generally infected, and has continued so to the present time. Up to 1869, it is estimated that England had lost, almost exclusively from this disease, 5,549,780 head of cattle, worth £83, 616,854 (say $400,000,000). For the succeeding nine years, up to 1878, the losses have been, in the main, as extensive, so that we may set them down as now reaching at least $500,000,000 in deaths alone, without counting all the contingent expenses, of deteriorated health, loss of markets, progeny, crops, manure, etc., disinfection, quarantine, etc. With us no attempts have been made to estimate the losses, but they cannot exceed a small fraction of those above named; and we have slept on in a pleasant dream of immunity.

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It is even alleged that the disease has, in a great measure, been shorn of its virulent power, by being transplanted to the shores of the New World, and that we may comfort ourselves with this, and continue to ignore its presence. If, on the other hand, it can be shown that the difference is in no material respect affected by the climate, but altogether determined by the surroundings, it will be well for us to attend to the facts of the case, and face the real danger. The lung fever, which had really entered England, by a special importation, some time before the free-trade act of 1842, was, by virtue of this act, thrown upon her in constantly accumulating accessions. The ports at which the continental cattle were landed, and the markets in which they were sold, — London (Smithfield Market), Southampton, Dover, Harwich, Hull, Newcastle, Edinburgh, etc.,— insured the mingling of the imported stock, week by week, with the native store cattle. Then, if they failed to find a profitable sale, they were sent by cars to other and inland markets, where they were again and again brought into contact with numerous herds of store cattle, by which the germs of the disease were taken in and carried all over the country.

With us, on the other hand, the disease was long confined to the dairies of Brooklyn and New York, where the cows were kept until they died, or were fattened for the butcher. A few doubtless found their way to the country, and by these the disease was carried to different farms, which were thus constituted centers of contagion from which the adjacent country became infected. But any such movement from the city dairies was necessarily of the most restricted kind, and it never took place to any great distance. It would have been folly to move a common milch cow, worth fifty to seventy dollars, to the West, where she could be bought for one-half or one-third of that sum. The same deterrent condition existed in the cases of the farms on which the diseased city cows had been brought. Sales were no doubt occasionally made from infected herds, to secure the apparent value of an animal which the owner had good reason to believe to be doomed, and as such animals would, for obvious reasons, be sent as far from home as possible, this became a principal means of the formation of more distant centers of contagion and the

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wider diffusion of the malady. But with us the disease has hitherto had to fight against the heaviest obstacles — the current of cattle traffic having been almost without exception from the cheaply-raised herds of the West to the profitable markets of the East. The exceptions have only been in the case of thorough-bred stock, and hitherto our Western stock has escaped contamination by this means.

The wonder is not so much that the plague has failed to reach the West, but that in the face of such tremendous obstacles it has succeeded in invading all of the six or seven States that are now infected. In Great Britain, where some would have us believe that the disease is more virulent, we can point to a more satisfactory record. There the great body of the country has been infected for thirty-five years, but the greater part of the highlands, exclusively devoted to the raising of cattle and sheep, has enjoyed the most perfect immunity. Here, under nearly all possible predisposing causes of lung disease,— altitude, exposure, cold, chilling rains, and fogs, the piercing blasts of the Atlantic and German Oceans, — this contagious lung disease has never penetrated, though severely ravaging the lowlands immediately adjacent. The explanation is, that these hills support none but the native black cattle, and other breeds are never introduced. In spite of the alleged virulence of the disease in England, it has proved powerless to enter this magic circle from which all but the native stock is excluded. The same holds true concerning some parts of Normandy, Brittany, the Channel Islands, Spain, Portugal, Norway, Sweden, etc.

The fact that the disease has maintained a foothold among us for thirty-four years, and in spite of all obstacles has made a slow but constant extension, is sufficient ground for the gravest apprehensions. A disease-poison which shows such an obstinate vitality and such persistent aggressiveness cannot be allowed to exist among us without the certainty of future losses which will eclipse those of Great Britain by as much as our herds of cattle exceed those of that nation. A recent outbreak in Clinton, N. J., caused by a cow brought from Ohio, suggests the possibility of the disease having already reached the latter State; an occurrence which was inevitable sooner or later, but the actual exist-

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ence of which must enormously increase our dangers. With every such step westward there is the introduction of more diseased and infected cattle into the natural current of the traffic, and the earlier probability of the general infection of all parts to the east of such ultimate centers of disease. There is, further, the infection of more cattle cars, which, carried West, may be the means of securing a rapid extension of the plague to our most distant States and Territories.

RELATIVE DANGERS OF THE POISONS OF LUNG FEVER AND OTHER PLAGUES.

The persistent vitality of the *lung-fever poison*, in comparison with that of any other animal plagues, is noteworthy. It has held a tenacious grasp on the United States for over a third of a century, though forbidden by circumstances to make a wide extension. *Aphthous fever* (foot and mouth disease), on the other hand, though twice imported into Canada within the last ten years, and on one occasion widely spread in New York and New England, was on each occasion easily and early extinguished, and with little or no effort on the part of the States. It might indeed almost be said to have died out of itself. Even the dreaded *rinderpest* has its poison early destroyed by free exposure to the air, in thin layers, at the ordinary summer temperature. Numerous experiments on hides hung up and freely exposed in warm weather have shown that the infecting power is lost as soon as they are quite dried. But the poison of lung fever maintains its virulence for months in the dry state in buildings, and we have known parks, with sheds, that proved regularly infected year after year to all cattle turned into them. In other cases we have known the virus carried for miles on the clothes of the attendants, and thus introduced into new herds.

A far greater danger lies in the lengthened period during which the poison of lung fever remains dormant in the system. This averages about three weeks or a month, but may extend, in exceptional cases, to not less than two months. An ox or a cow which has been exposed to the contagion may, therefore, be carried from one extremity of the continent to the other, may be exposed in a succession of markets, and may change hands an

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indefinite number of times, and be all the while in the best apparent health, though infallibly approaching the manifestation of the disease, and for the latter portion of time spreading the germs of the malady to others. There is here an opportunity for the unscrupulous to sell off exposed and infected animals without the purchaser's having the least suspicion of foul play. There is also the strong probability of animals that have contracted the disease by accident, in cars or otherwise, in passing to a new home, mingling with the herd of the new owner and infecting them extensively before there is a suspicion that anything is amiss. This long period of incubation after the animal is infected, and the equally long period of latency of the malady in animals he has infected, one or two of which only will be attacked at intervals of a month, lull suspicion as to the presence of contagion, and it is too often only after great damage has been done that the truth dawns on the mind.

In aphthous fever and rinderpest, on the other hand, the disease shows itself in from one to four days after infection, and the surrounding animals are so rapidly attacked after the coming of the infected stranger, that there is no room for hesitancy as to the existence of contagion. Nor can the victims of these diseases be carried far from the point where they have been infected and disposed of as sound animals; so that in the very vigor and promptitude of their action we have an excellent basis for their restriction and control.

DANGER OF INFECTION IN OUR UNFENCED STOCK-RANGES.

It is needful to note the above-named insidious progress and stealthy invasions of the lung fever, and to contrast them with the more prompt and open manifestations of the other animal plagues, in order to show the great peril to which we are subjected by the presence in our midst of a *pestilence* which literally *walketh in darkness*. Let us now consider the prospective infection of our great stock-ranges. That this is inevitable, though slow, at the present rate of progress of the plague, has been sufficiently shown. That it might occur any day by an animal infected in an Eastern farm or stock-yard, or in a railroad car in which it was sent for the improvement of the Western herds,

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must be abundantly evident to every one who has read this article. If we now add the fact that more than one *thorough-bred Ayrshire* and *Jersey* herd has been infected with this disease during the past year, we are at once confronted with a strong probability of an early Western infection. Let us remember that thorough-breds alone are carried West for improvement of native herds, and that a bull of the Ayrshire, Jersey, Holstein, or Shorthorn breed, taken from a herd now or recently infected, may be carried to any of our Western Territories and mingle for a month with the native herds before his own infection is so much as suspected, and we can conceive how imminent is the danger when the infection has reached our *Eastern thorough-bred cattle.*

To illustrate the result of the infection of our unfenced stock-ranges, I must quote another page from the history of this disease in other countries. The instance of Australia is the most recent as well as the most striking. The lung fever was introduced into Melbourne in 1858, by a Shorthorn English cow, which died soon after landing. Having been confined to an inclosed place, there is every reason to believe that with her the disease would have ended, had not a teamster turned his yoke of oxen into the infected park under cover of the night. These oxen working on the streets infected others, the disease soon spread to the open country, and the mortality increased at an alarming rate. Vigorous measures for its suppression were adopted, thousands of infected and diseased cattle were slaughtered, but all proved of no avail. Not only were the free, roaming herds infected, but so many places were contaminated that it was soon perceived that help from this source was not to be expected. Destroy a whole infected herd, and you still left the infection in the station from which, in its unfenced state, other herds could not be excluded, and where they were certain to take in the germs of the malady. After enormous losses had been sustained by the combined operations of the pest and the pole-ax, it was concluded that the remedy was worse than the disease, and the colonists reluctantly fell back on the expedient of inoculation. This is based on the fact that the disease is rarely contracted a second time by the same animal, and it can

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be practiced on all calves with losses at the rate of from two to five per cent only, so that the mortality is insignificant as compared with the thirty to fifty per cent which perish where the affection is contracted in the ordinary way. The great objection to inoculation is, that it can only be practiced at the expense of a universal diffusion of the poison, and of its maintenance in a state of constant activity and growth. With such a universal diffusion of the virus, the stock-owners are virtually debarred from introducing any new stock for improving the native breeds, or infusing new vigor or stamina, inasmuch as such new arrivals would almost certainly fall early victims to the plague. Australia, therefore, now suffers from the permanent incubus of the lung plague, and can only import high-class cattle at great risk.

This is an occurrence of yesterday, but it is only a repetition of the immemorial experience of the steppes of Russia. There we find the same conditions of great herds roaming free over immense uninclosed tracts, and all the facilities for an easy and wide diffusion of animal poisons. There, accordingly, we find the home, in all ages, of the animal plagues of the Old World. To these endless steppes Europe and European colonists owe their frequent invasions of *lung fever, rinderpest, aphthous fever and sheep-pox.* To these are to be charged the losses, to be estimated only by many thousands of millions, which have repeatedly fallen on the other civilized countries of the world. From these steppes the disease has spread over the continent on the occasion of every great European war, dating from the expulsion of the Goths from Hungary by Attila and his Huns, in A. D. 376, down to the recent Turkish war, which has secured the extension of the rinderpest to Hungary at least. On these steppes, too, the Russian veterinarians believe the rinderpest, at least, to be an imported disease derived from Eastern and Central Asia, yet all their efforts to crush out this or the lung fever, though receiving the freest support from the Russian government, have failed. The same conditions exist, to a large extent, at the Cape of Good Hope; and there, too, the lung fever, imported in 1854, has acquired a permanent residence.

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PREVENTIVE MEASURES DEMANDED.

Such is the history. Now comes the question pregnant with weal or woe to our future stock, agricultural, and national interests: Shall we learn from the disastrous experience of others and extirpate the lung plague from the United States while it is still possible, or shall we sit quietly by with folded hands and await the inevitable, early or late, infection of our open Western stock-ranges, and then repeat, for the benefit of other nations, the already twice-told tale of a desperate and extravagant but fruitless attempt to suppress a plague which we have criminally allowed to pass beyond our control? With or without a prodigal but vain effort to crush out the poison, the results may be thus summed up: The infection of stock-yards, loading-banks, cars, and markets, and a general diffusion of the plague over the Eastern States. This would imply a national loss, by cattle disease, like that of England, but much more extensive in ratio with our great numbers of stock. Thus England, with her six million head of cattle, has lost in deaths alone from lung fever in the course of forty years over five hundred million dollars. We, therefore, with our twenty-eight millions, should lose not less than two billion dollars in the same length of time, allowing still a wide margin for the lower average value per head in America. And this terrible drain is for deaths alone, without counting all the expenses of deteriorated health in the survivors, of produce lost, of loss of progeny, of loss of fodder no longer safe to feed to cattle, of diminished harvests for lack of cultivation and manure, of quarantine and separate attendants whenever new stock is brought on a farm, of cleansing and disinfection of sheds and buildings, etc., which become absolutely essential in the circumstances.

We do not include the expense of supervising the trade, examining and quarantining the stock at the frontier of every State, and of the disinfection of cars, loading-banks, stock-yards, and markets. If such were resorted to, after an extensive infection of our Western herds by lung fever, the cattle trade would be virtually stopped. Thus a safe quarantine for store cattle could not be less than three weeks, and a registration and supervis-

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ion for five weeks more on the farms to which they are taken, would be absolutely essential. Thus the quarantine yards and sheds would be continual centers of infection, and would require to be very extensive, thoroughly isolated from each other, and constantly and perfectly disinfected, the air as well as the solids, to prevent the infection of newly-arrived stock. Such an incubus upon the trade would amount to a virtual prohibition. In rinderpest, sheep-pox, and aphthous fever, quarantine is a comparatively simple and available expedient, as the disease shows itself within a week; but in lung fever, with the germs lying unsuspected in the system for one or two months, a protective quarantine is practically impossible wherever an active cattle trade is carried on. Hence in the countries of Central and Western Europe, through which the active traffic from the East is carried on, a complete control is usually maintained over rinderpest and sheep-pox, while the people have resigned themselves to the prevalence of lung fever as an unavoidable infliction. The same holds in Great Britain. Twice within eleven years has she crushed out invasions of rinderpest, and repeatedly has the same thing been accomplished for sheep-pox; but the lung fever is accepted as a necessary evil, between which and her large importations of continental cattle she must make a deliberate choice.

Happily, in these United States we are as yet under no such compulsion. The lung fever on American soil is still confined to the Eastern States and to inclosed farms, from which it is quite possible to eradicate it thoroughly. Of this possibility we have abundant evidence, alike in the Old World and the New. In several countries of Western Europe, through which there is no continuous cattle traffic between nations on opposite sides, this disease has been killed out and permanently excluded by an intelligent veterinary sanitary supervision. Sweden imported the disease in Ayrshire stock in 1847, but at once circumscribed the infected herds and places, slaughtered the diseased, disinfected all with which they had come in contact, and promptly extinguished the outbreak. Denmark, invaded the same year from a similar source, and on several subsequent occasions from Holland and England, as often quenched the poison by analo-

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gous measures. Oldenburg, Schleswig, and Norway, successively invaded by the importation of infected Ayrshires, in 1858, 1859, and 1860, respectively, enjoyed a similar happy riddance, through the application of the same system of suppression. Switzerland, long slandered as the native home of the lung plague, has at last awoke to the truth of the statement of the immortal Haller, made more than a century ago, that this disease only occurs "when an animal has been brought from an infected district;" and, by the judicious use of suppressive measures, has permanently rid the country of the pestilence, and demonstrated that their Alpine air is as clear and wholesome for beast as for man.

In America, Massachusetts and Connecticut have furnished examples equally striking. The former imported the disease in Dutch cattle in May, 1859. In April, 1860, when it had gained nearly a year's headway, an act was passed, and a commission appointed, with full power to extirpate it. After the slaughter of nine hundred and thirty-two cattle, it was believed that this had been achieved; but new centers of infection were discovered in the two succeeding years, and it was not until 1865 that the commonwealth was purged of the poison. Since that year the lung fever has been unknown in Massachusetts. Connecticut has had a similar experience. Her proximity to New York City and Long Island has brought upon her a series of invasions; but, profiting by the experience of her neighbor, she has, on each occasion, grappled successfully with the enemy, and driven him from her midst.

What has been done by the Scandinavian nations, by Oldenburg and Switzerland, by Massachusetts and Connecticut, can be done by all of our Eastern States. On this point the teaching of history is as unequivocal as on the certainty of the irreparable results if our open Western stock-ranges were infected. The one indispensable prerequisite to success is the vigorous and simultaneous action of the various infected States, and its persistent maintenance until the last infected beast has disappeared and the last contaminated place or thing has been purified. It matters little whether controlled by State or national government, if vigor and uniformity of action can be secured;

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but, as such combined and unflagging work is necessary, it could be best controlled by an intelligent central authority. The United States government is as much called upon to defend her possessions against an enemy like this — so implacable, so relentless, and so certain, if not repelled, to lay us under an incubus which will increase with the coming centuries, and dwarf the prosperity to which we are entitled — as against the less insidious one who attacks us openly with fire and sword. Let the national Congress consider this matter well. Let every stock-owner press it upon his representative as a matter that cannot be safely ignored even for a single day. Let boards of agriculture, farmers' clubs, and conventions, granges, and all citizens who value the future well-being of the nation, unite in a strong representation on the subject. If the present Congress should neglect it, let citizens make it a test question to every future candidate for their suffrages, and elect only such as are pledged to carry suppressive measures into effect. The danger threatens all classes alike, though the first sufferers will be the stock-owners; for every tax upon production necessarily enhances the value of the product; and, as agricultural progress must be seriously retarded, the tax will not fall upon meat alone, but upon every product of the farm. Nothing can excuse a continued neglect of this subject, the dangers surrounding which increase from day to day, and the final results of which, if once it reaches our Western and Southern States and Territories, can only be computed by the prospective increase of our population and our herds of cattle. For this is not like an evil preying on our currency, banking, trade, or manufactures, the full extent of which may be, in a great measure, seen from the beginning, and the repair of which may be at any time inaugurated by legislative enactment. The animal plague only increases its devastations as we increase the numbers of our herds, and threatens soon to acquire an extension to which no legislation can oppose a check, and a prevalence in the face of which the most desperate efforts of the nation will prove of no avail. Thus our cattle are increasing at the rate of thirteen and one-half millions every ten years, so that by the end of this century they may be exactly doubled, with a prospective loss, if

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our Western and Southern ranges are infected, of one hundred and thirty millions of dollars yearly in deaths alone.

The choice is now in our power. So far as we know, our stock-raising States and Territories are still unaffected. We can still successfully meet and expel the invader; next year it may be too late.

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GLANDERS AND FARCY.*

BY DR. H. J. DETMERS, V. S., OF CHICAGO, ILL.

GLANDERS is a contagious disease *sui generis* of animals belonging to the genus *equus*. It has usually a chronic course, can be communicated by means of its contagion to several other species of animals and to human beings, and must be considered incurable if fully developed. The principal seat of the morbid process is usually in the mucous membrane of the nasal cavities. Three main symptoms, viz., discharges from the nose, swelling of the submaxillary lymphatic glands, and particularly ulcers of a peculiar, chancrous character in the mucous membrane of the septum of the nose, characterize glanders, and are, therefore, of the greatest diagnostic value. Wherever these three symptoms, or only two of them, are present and fully developed, there the diagnosis is secured. But unfortunately this is not always the case; sometimes two, and even all three, principal symptoms may be wanting, and still the horse may be affected with glanders. In such a case the seat of the morbid process is not in the nasal cavities, but further on in the respiratory passages, or even in the lungs. Several such cases have come to my observation. In still other cases, in which the disease might be called "external glanders," but is better known by the name of "*farcy*," the morbid process has its principal, or even its exclusive, seat in the subcutaneous connective tissue and in the skin or cutis. The late Professor Gerlach, in his treatise on glanders, published in 1868, discriminates, in conse-

* Extracts from Report of Commissioner of Agriculture.

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quence of these differences, three distinct forms: Nasal or common glanders, pulmonal glanders, and farcy. As such a division of glanders proper into nasal and pulmonal glanders — farcy is described by every author under a separate head — facilitates considerably the diagnosis, and explains also at once why just those symptoms which are usually looked upon as most characteristic remain sometimes imperfectly developed, or entirely unobserved, it will be convenient to adopt Gerlach's classification.

NASAL GLANDERS.

This form is that which is most common, best known, and characterized by the three principal symptoms which have been mentioned.

(*a.*) *The discharge from the nose*, although the most conspicuous of those three symptoms, is really the one which is the least characteristic, or of the least diagnostic value, because several other diseases of the respiratory organs are also attended with discharges from the nose, which are more or less similar. It is true, the discharge in glanders possesses some properties which, if considered as a total, are characteristic and are not found combined in any other disease; but the difficulty is, one or another of these qualities is not always sufficiently developed. Consequently, if the other two principal symptoms, the swelling of the lymphatic glands and the ulcers in the nose, are absent or not observed, the discharges from the nose are seldom characteristic enough to serve as the sole basis of a reliable diagnosis. The same are frequently one-sided, and, according to most authors, oftener from the left than from the right nostril. According to my experience they are nearly, if not quite, as often from the right as from the left nasal cavity, and, at any rate, just as often from both nostrils as from one only, but always more abundant from one, either right or left, than from the other. At the beginning the discharges are usually thin, almost watery, frequently greenish, or somewhat similar in color to grass juice; afterward the same appear to be composed of two different fluds, one yellowish and watery, and the other whitish and mucous. Still later the discharges become thicker, more sticky, exhibit

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frequently a mixture of different colors, are sometimes greenish, sometimes dirty white or grayish, contain not seldom streaks of blood, and, in advanced stages especially, particles of bone or cartilage. They have a great tendency to adhere to the borders of the nostrils and to dry there to dirty yellow-brownish crusts. As to quantity, the nasal discharges in glanders are seldom very copious, at least not as copious as in many other diseases — strangles, for instance. The quantity, however, varies. Sometimes, especially when the weather is warm and dry, the discharges may be very insignificant or be absent altogether, and at other times, particularly if the weather is rough, wet, and cold, will increase in quantity, and become comparatively abundant.

(*b.*) *A distinctly limited swelling of the submaxillary lymphatic glands* constitutes the second essential symptom, which is more characteristic of glanders, and of greater diagnostic value than the discharge from the nose. The swelling corresponds to the discharge; that is, if the latter is one-sided, for instance, from the left nostril only, the glands of the corresponding left side of the head are affected, and if the discharge is from both nostrils, the glands of both sides are swelled, but always those of that side the most on which the discharge is most copious. The swelling does not exhibit any conspicuous sign of inflammation, and is usually not painful, except at the beginning or after a sudden increase of the morbid process. It is always distinctly limited, and the swelled gland is always hard and usually of the shape and size of a peanut; may occasionally, however, be found as large as a hen's egg. Large inflammatory swellings without distinct limits, do not belong to glanders. At first the swelled glands are more or less movable beneath the skin, but afterwards, in an advanced stage of the disease, the same frequently appear to be attached more or less firmly to the bone, and are immovable. The swelling, unless irritated by external causes, never dissolves in suppuration like the inflammatory swellings common in distemper, and is absent only if the lymphatic glands have been extirpated, if the lymphatics have become obliterated, or if the morbid process in the mucous membrane of the respiratory passages is situated too high to be within the province of those lymphatics which are connected

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with the submaxillary glands, for the swelling is caused solely by a deposit of deleterious matter which has been absorbed by the lymphatics.

(*c.*) *Ulcers of a peculiar, chancrous character* on the mucous membrane of the nose, and especially of the septum or cartilaginous partition between the nasal cavities, constitute by far the most characteristic symptom, and, in fact, the only one which makes the diagnosis a certainty, even if all other symptoms should be absent or imperfectly developed. Still, such is never the case; if there are ulcers in the nose, then there is also a discharge of matter mixed with mucus from the corresponding nostril. In some cases these ulcers are present, but are situated too high to be seen unless the horse is examined in bright sunlight, and the rays of the sun are reflected by a mirror into the cavity of the nose. The seat of the ulcers is usually on the septum and near the nasal bone. Their size and shape vary. Some ulcers are small, isolated, almost round; others are large, of an irregular shape, and of uneven depth. All produce matter, have elevated, corroded borders, a dirty, steatomatous-looking bottom, and are never covered with a scab. At first, small gray specks or elevated gray spots (glanders-nodules), varying in size from that of a pin's head to that of a pea, make their appearance. These nodules soon decay and form ulcers. Gradually the ulcers increase in size and depth; their borders become more elevated and corroded; the process of decay goes on; and if two or more small ulcers are close together, they become confluent, unite, and constitute one large, irregularly-shaped ulcer which continues to increase in size and depth. Decay and destruction work their way deeper and deeper, even into the cartilage, and if ulcers happen to be existing in both cavities, or on both sides of the septum, it occurs not seldom that the latter becomes perforated.

Sometimes it happens that a glanders-ulcer shows a tendency to heal; it loses its chancrous character; granulation makes its appearance; a scurf or scab is formed; a healing takes place, and a fibrous, whitish-colored, somewhat puckered or star-shaped scar is left behind.

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Some authors have attached considerable diagnostic importance to a bluish or lead-gray color of the nasal mucous membrane, and to bluish or lead-gray spots, which usually make their appearance before it comes to ulceration. Such a bluish color, however, is not a constant symptom; in some cases only small red specks can be seen on an otherwise rather pale mucous membrane, and is not characteristic either, because it is observed also in catarrhal diseases, and in horses driven against the wind in cold weather.

(*d.*) *Minor symptoms.* — The three principal symptoms just described are usually accompanied by some others of minor diagnostic value, but under certain circumstances very important, especially if one or another of the principal symptoms should happen to be imperfectly developed. As such minor symptoms, may be mentioned, first, an accumulation of a glassy, whitish-gray mucus in the inner canthus or corner of the eye of the diseased side of the head. It is a symptom which usually makes its appearance at the beginning of the disease; second, a lusterless, dry, and dirty-looking, or so-called "dead" coat of hair; third, more or less difficulty in breathing; fourth, a peculiar short and dry cough, somewhat similar to the well-known cough of a horse affected with heaves. These last three symptoms, of which the cough is the most characteristic, make their appearance only after the morbid process has made considerable progress. In some cases the plain outbreak of the disease, or the appearance of plain and unmistakable symptoms, is preceded by a swelling of the inguinal, the axillary, and other lymphatic glands.

The difficulty of breathing, and the peculiar and somewhat characteristic cough, though only minor symptoms in common or nasal glanders, rise to great diagnostic importance if the morbid process has its principal seat in the lungs instead of the mucous membrane of the nasal cavities — if, in other words, the animal is affected with that form of the disease which Professor Gerlach has called "pulmonal glanders."

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PULMONAL GLANDERS.

It happens sometimes that a horse is affected with glanders and communicates the disease to other healthy animals, but does not itself show any of the three principal symptoms characteristic of that disease; has no discharge from the nose, no swelled glands, or ulcers in the nasal cavities.

Some cases have come under my own observation. In pulmonal glanders the morbid process has its principal seat in the lungs, and may remain limited to the latter for months, and even for one or two years; and during that time, or as long as the morbid process is confined to the lungs, no prominent symptoms may make their appearance except such as are usual attendants upon heaves — some difficulty of breathing, and a peculiar short, weak, and dull cough, which must be heard, but is not easily described. Finally, however, but not before the disease has made considerable progress, the difficulty of breathing increases, more or less discharge from the nose makes its appearance, emaciation sets in, the natural glossiness of the coat of hair disappears and becomes rough, stands on end, and exhibits a so-called dead and dirty-looking appearance. The skin, too, loses some of its natural elasticity, and the animal becomes "hide-bound."

The morbid changes are revealed only at the *post-mortem* examination. Smaller and larger glanders-nodules (usually called tubercles) present themselves in different stages of development and subsequent decay in the tissue of the lungs. Some of them constitute formations rich in glanders-cells, and others, especially if the disease is of long standing, as decayed, cheesy, dried, and shrunk substances and glanders-tumors of a sarcomatous and fibroid character. In some of the oldest ones even a deposit of lime-salts may have taken place.

As the principal symptoms of pulmonal glanders are essentially, for some length of time at least, only such as are also observed in common cases of heaves (one of the most frequent disorders of horses), the diagnosis must frequently be based, as a lawyer would say, upon circumstantial evidence.

A horse must be suspected of being affected with glanders, first, if the peculiar weak and dry cough constitutes, compared

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with the difficulty of breathing, the predominating symptom ; if the animal becomes more and more emaciated and hide-bound, and if the appearance of the coat of hair is such as to indicate the presence of a cachectic disease. Second, if it is known that the animal in question has been exposed to the contagion. Third, if other horses have become affected with glanders or farcy, after having been together with the animal that shows those symptoms. Fourth, if a horse apparently affected with heaves has previously exhibited other symptoms, more or less characteristic or suspicious, of glanders. Fifth, if other symptoms, such as are observed in so-called "nasal gleet," or incipient nasal glanders, make their appearance.

FARCY, OR EXTERNAL GLANDERS.

The name "farcy" is given to such cases of glanders in which the morbid process has its seat in and immediately beneath the skin, and in which nodules, boils (glanders-buboes), and ulcers of a very infectious and chancrous character make their appearance in the subcutaneous tissue, and in the skin itself. Glanders-nodules and lenticular ulcers in the tissue of the skin, boils beneath the skin, smaller and larger open ulcers penetrating the same, a strand-shaped swelling of the subcutaneous lymphatics, swelled lymphatic glands, and œdemata, the latter especially in the legs and on the head, constitute the most essential symptoms.

Professor Gerlach discriminates two forms: Subcutaneous glanders or common farcy, and exanthematous glanders or skin farcy.

(*a.*) *Subcutaneous glanders or common farcy.* — The morbid process in this rather frequent disease has its principal seat in the subcutaneous connective tissue, and in the lymphatic system of the skin and between the skin and the muscles, but especially on the inner side of the hind legs, on the hips, on the neck, between the fore legs, and on all such places where the skin is thin and fine. At first distinctly limited swellings of an inflammatory character (incipient boils or glanders-buboes) make their appearance in the subcutaneous tissue. These swellings or boils soon commence to dissolve, or to decay, from within ; the ulcer-

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ation begins in the center, but the matter, being very corrosive, soon works its way into the skin, the boil finally opens, and presents a farcy-ulcer with a steatomatous bottom, and elevated, corroded, and inflamed borders. At the same time, or even before the formation of the first ulcer has become completed, deleterious matter is absorbed by the nearest lymphatics, and deposited in the lymphatic glands. The former, in consequence, swell to hard and plainly visible cords or strands, and the latter to painful and distinctly limited tumors. The partial or total closing of the lymphatic vessels and glands thus effected interferes with, and even prevents, a performance of their functions, or stops the absorption of lymph, and œdematous swellings, more or less extensive, are the necessary consequence. The same make their appearance especially if the seat of the morbid process is on the inside of a leg, and if either the inguinal or axillary glands are swelled and closed by a deposit of deleterious matter. The more extensive and complete the swelling and closing of the lymphatic vessels and glands, or the more lymphatics are affected, the more extensive is also the œdema. Lameness, usually caused by such an œdema, is also a frequent attendant.

The roundish boils or tumors increase in size from that of a hazel-nut to that of a hen's egg. At first, when such a boil is making its appearance, it is not fastened to the skin; the latter can yet be moved a little in every direction over the boil; but soon the neoplastic process and the subsequent decay will extend to the tissue of the skin, and boil and skin will become firmly united before the ulcer breaks and discharges its extremely infectious and corrosive contents, consisting of decaying glanders-cells or matter, and lymph.

(*b.*) *Exanthematous glanders or skin farcy.* — In this form of glanders or farcy the principal seat of the morbid process is in the tissue and in the lymphatics of the skin or cutis. It is a rare form in horses, but the only one in which external glanders or farcy makes its appearance in a human being. Distinctly limited swellings (nodules and tumors) of the size of a pea to that of a hazel-nut, either isolated, or united and resembling a string of beads, make their appearance in the tissue of the skin.

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These swellings soon break, and then present round ulcers with elevated and corroded borders. The discharge consists of a mixture of matter, composed mainly of decayed glanders-cells and lymph.

NASAL GLEET.

This is a name which I have accepted only with great reluctance, because it signifies no definite disease, and is used frequently, as I shall hereafter have an opportunity to show, to cover ignorance, fraud, and crime. It can be retained only if applied exclusively to such cases of disease (usually occult or incipient glanders) in which the horse has a suspicious-looking discharge from the nose, but shows no other characteristic symptoms sufficiently developed to base upon them a sure diagnosis. So, for instance, it may happen that a horse has chronic discharge of matter and mucus from one or both nostrils, and, perhaps, also a distinctly limited swelling of the submaxillary lymphatic glands, and yet neither the discharge nor the swelling may be sufficiently characteristic to justify the belief that the horse in question is affected with glanders, because the latter is a disease which, for obvious reasons, demands a correct and positive diagnosis. To declare that a horse has glanders is equal to condemning the same to be killed. The term "nasal gleet," therefore, is convenient and admissible, if used exclusively to signify a disorder of the respiratory organs, attended with suspicious discharges from the nose, and other symptoms common in glanders, but not yet fully enough developed or sufficiently characteristic, one way or another, to make the existence or absence of glanders a certainty. Such a disorder, of course, must be considered as incipient or occult glanders till every doubt has been removed.

Chronic and acute glanders. — Glanders, as a rule, is a chronic disease. The morbid changes develop slowly. Of the various forms in which the disease is able to make its appearance, pulmonal glanders, unless complicated with one of the other forms, or with other inflammatory or feverish diseases, is the most chronic, or takes the longest time to produce conspicuous symptoms and to become fatal. It takes frequently two or three

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years before the animal succumbs. Nasal glanders is usually not quite so slow in its progress ; still it also very often takes half a year longer before the morbid process makes sufficient headway to produce plain, unmistakable symptoms, or before the chancrous ulcers, characteristic of glanders, make their appearance in the mucous membrane of the septum of the nose. Farcy, or external glanders, is usually the least chronic (comes the soonest to a termination) of the various (uncombined) forms of glanders. Plain and unmistakable symptoms (veritable farcy-ulcers) make their appearance almost always within three months and frequently within a week or two after the infection has taken place. In mules and asses, however, the various forms of glanders are usually less chronic, make a more rapid progress, are more destructive, and come sooner to a termination than in horses. The progress of the morbid process depends also to a great extent upon the constitution and the organization of the animal and the mode and manner in which it is kept. Weather and temperature, too, have considerable influence; warm and dry weather usually retards, and cold, wet, and stormy or inclement weather usually accelerates and spreads the morbid process. Most authors discriminate between acute and a chronic form of glanders. From a practical standpoint such a distinction is perfectly admissible, but to separate acute and chronic glanders as two different diseases, as has been done by some (French) authors, must lead, and has led, to very dangerous mistakes and to great confusion. Every form of glanders, as I have said before, is naturally more or less chronic in its course, but may become acute, either from the first beginning or at any stage of its development, and sometimes very suddenly, under any of the following conditions : —

1. If a complication takes place either with one of the other forms of glanders or with another disease or disorder. Sometimes even a small wound is sufficient to inaugurate the acute course or a rapid progress of the morbid process.

2. If glanders has been communicated by a direct introduction of glanders-matter into a wound, or a direct contact of the contagion with the blood. The greater the quantity of glanders-matter introduced, the more concentrated the contagion inocu-

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lated, or the larger the wound, the more acute or rapidly progressing and spreading is usually the morbid process of the communicated disease.

3. If the constitution of the animal has been weakened, or if the vitality of its organism has been seriously impaired either by glanders itself or by any other disease, although the course of glanders is naturally slow or chronic from the beginning, it is usually changed to an acute one as soon as the morbid changes have become sufficiently important and extensive to weaken essentially the constitution of the animal, and to cause a profuse infection or spreading of the contagion through the lymphatics in the animal organism. Toward its fatal termination, glanders, therefore, always changes its course from chronic to acute. Unlike most other diseases it commences chronic and ends acute.

4. Exposure to wet, cold, and inclement weather, catching cold, hard work, close, dirty, and ill-ventilated stables, unhealthy food, etc., — in short, everything that is calculated to produce an injurious influence upon the organism, or is calculated to impair the health of the animal, has a tendency to accelerate the morbid process, to change the chronic course of glanders to an acute one, and to hasten the outbreak after an infection has taken place.

The morbid process of glanders is accelerated and caused to spread more rapidly if the latter becomes complicated with an inflammation, or with any very feverish or very typhoid disease. The morbid processes of glanders and inflammation increase each other reciprocally. The inflammatory process adopts, to a great extent, the nature and characteristics of glanders, and the morbid process of the latter disease becomes blended with the former, and assumes the attributes of an inflammation. In either case all the symptoms become very violent, and the morbid process progresses and spreads very rapidly, particularly in those tissues which are in a state of inflammation. Ulceration, too, becomes extensive in a short time, and the lymphatics, by absorbing the deleterious matter, seem to spread the contagion and the elements of glanders rapidly through the whole system. If the original disease is glanders, farcy will also make its appearance within a short time; and *vice versa*, existing farcy

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will soon be complicated with nasal and pulmonal glanders of an inflammatory character. The exudations produced by an inflammation which has assumed the nature of glanders are always very deleterious and corrosive and destroy like a caustic the tissues with which they come in contact. The morbid changes effected by such an inflammation resemble those of a malignant diphtheria. In extreme cases the morbid process may become so violent as to cause the neoplastic process, characteristic of glanders, to be superseded by immediate destruction and mortification. In such a case, profuse diphtheritic ulceration and destruction of tissue take the place of the neoplastic production of glanders-cells and their subsequent decay. The glanders-cells are destroyed (decay or perish) before their formation has been completed, consequently are absent.

Wherever glanders presents itself as an acute disease, either an uncommonly large quantity of the contagion has been introduced at once and brought in direct contact with the blood, or a complication of some sort has been effected.

THE NATURE OF GLANDERS.

The hypothesis in regard to the nature of glanders, and the theories concerning the morbid changes and their relative importance, have differed very widely, and have recently undergone great changes. Although modern investigations have proved beyond a reasonable doubt that all the old hypotheses are erroneous, some of them soon get to have their adherents.

Glanders commences as a neoplastic process — new morbid formations (glanders-cells) are produced. The mucous membrane of the respiratory passage, the lungs, the subcutaneous tissue and the cutis, and occasionally some of the connective tissues of other parts of the body, constitute the primary seat of the morbid changes. The lymphatic vessels and glands become secondarily affected. The neoplastic process, however, does not in every case of glanders occur in all those tissues named; its seat in a certain tissue determines the form of the disease. In common or nasal glanders the morbid changes have their main seat in the mucous membrane of the nasal cavities, and of the maxillary sinuses; in pulmonal glanders the

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same make their appearance principally in the lungs; and in farcy the neoplastic process is taking place either in the subcutaneous connective tissue (common farcy), or in the cutis itself (skin farcy). In other tissues, morbid changes, as a general rule, occur only if glanders has become complicated with another disease — an inflammatory process, for instance. The products of the neoplastic process consist of round cells, and of spindle-shaped cells. The latter, usually, undergo further changes; some of them develop to round cells, and others serve as the elements of excessive or morbid growths of connective tissue, which, however, do not present anything characteristic, and must be considered as subordinate products of the neoplastic process. The round cells are in shape and form similar to granulation cells and matter-corpuscles, but vary in size from that of the latter to two, three, four, five, and in some cases even ten times as large. The youngest round-cells, or those latest produced, present rather delicate outlines, and are the smallest; the oldest ones, which are distinguished by their granulated contents and their dark color, are the largest, and sometimes very large. All have large nuclei, which grow in the same proportion as the cells, and present in the older ones a dark, granulated appearance.

The formation of these cells constitutes the real formation of all the morbid changes in glanders, and may, therefore, be considered as something characteristic of the disease, and the cells themselves are appropriately designated as glander-cells. These glander-cells have two different sources; they proceed from connective-tissue corpuscles, and also from epithelium-cells.

1. *Development of glanders-cells from connective-tissue corpuscles.* The latter become proliferous and swell; the nucleus of each cell or corpuscle grows larger; a second and a third nucleus are produced within the walls of the cell, but not by a division of the first one. The other contents of the cell gradually granulate, the appendages or extensions drop off; finally the whole body of the cell decays. The nuclei become free; the nucleus-envelope or membrane expands, and becomes distinct from the interior, and the metamorphosis of a nucleus into a nucleated cell is thus completed. Such a new cell presents at first a very

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delicate contour and a large and bright nucleus, but, under favorable circumstances, will soon become firmer and grow larger. Under unfavorable conditions no further development will take place.

2. *Development of glanders-cells from epithelium-cells.* — A process of proliferation makes its appearance in the tesselated and cylindrical epithelium-cells, is plainest, however, in the latter. At first the oval nucleus increases in size; then a second, and finally a third nucleus are formed at a little distance from the upper obtuse end of the first, which is not divided. The formation and growth of these nuclei cause the cylindrical cell to increase in size, or to swell, and to change its original shape till it is transformed to a mere bag filled with nuclei and small round cells. Finally the bag or the old cell-membrane decays and breaks, and the nuclei and young cells are liberated. Such a production or development of glanders-cells just described can take place in young or undeveloped and incipient epithelium-cells, because round giant-cells filled with nuclei and small round cells are formed frequently in the deeper or youngest strata of the epithelium.

THE ANATOMICAL CHANGES.

The morbid products of the glanders-process make their appearance usually in more or less distinctly limited nests, or in shape of nodules or tubercles and tumors, which vary considerably in size. Some of them are as small as the size of a pin's head, and are called miliary tubercles; others are larger, of the size of a pea; and still others are quite large, and constitute tumors or glanders-excrescences. Practically, therefore, a discrimination between glanders-tubercles or small nests of glanders-cells, and tumors or large ones, is admissible. The former, however, must not be looked upon as identical with genuine tubercles as occurring in tuberculosis. A glanders-tubercle is a different thing altogether, only the name has become too convenient to be abolished. Glanders-tubercles occur — 1, in the substance and in the subserous tissue of the lungs; 2, in the mucous membrane of the nasal cavities and of the maxillary sinuses, but especially in the mucous membrane of the septum;

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3, in the swelled and indurated submaxillary glands; and, 4, in the cutis. Some authors have considered the presence of small miliary tubercles in the lungs as the criterion of the presence of glanders, but others have found that glanders may exist and still no tubercles may be found in the lungs. Glanders-tubercles make their appearance in the lungs only if the morbid process, which has its principal seat usually — I would like to say, normally — in the mucous membrane of the nose, extends to the lungs; or if original nasal glanders has become complicated with pulmonal glanders, which, in the course of time, is a common occurrence. In those cases in which such a complication is existing from the beginning, or in which pulmonal glanders constitutes the primary disease and nasal glanders the complication, miliary tubercles are found in the lungs frequently within a short time after an infection has taken place, sometimes within from one to three weeks. The same are imbedded in the healthy pulmonal tissue, are surrounded by a court of turgid blood-vessels, have each a small blood-vessel of their own, are at first grayish-white and rather soft, consist of more or less uniform and rather small round cells, with nuclei, connected with each other by a delicate intercellulary tissue, and become, when older, enveloped by a fine tissue of connective fibers. The court of turgid or congested vessels around the tubercles disappears after some time, the blood-vessel which enters the tubercle becomes obliterated, and the substance of the latter, receiving no more nutriment, undergoes decay. A necrobiotic process commences, the round cells shrink, the intercellulary substance decays, and the interior of the tubercle is changed to a cheesy substance, in which finally lime-salts are deposited. The whole process is the same as that which is taking place in a true tubercle in tuberculosis, therefore every difference disappears after the retrogressive process has set in. Hence, glanders-tubercles have frequently been identified with veritable or tuberculosis tubercles, and glanders itself has, at times, been looked upon as a tuberculosis of horses, which assumes peculiar forms, different from tuberculosis of other animals; but as real common tuberculosis occurs in horses as an independent disease, the same as in other animals, as the cells of a glanders-tubercle are usually

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somewhat larger than those of a genuine (tuberculosis) tubercle, and as, finally, each glanders-tubercle possesses a full intercellulary substance, and has a blood-vessel of its own, either of which is wanting in the veritable (tuberculosis) tubercle, there can be no doubt as to glanders and tuberculosis of horses being entirely different diseases. Besides that, in tuberculosis of horses, the single tubercles are usually a great deal larger than the miliary tubercles of glanders, and only the smallest ones (those of the size of a pea) present some similarity to the larger glanders-tubercles. The retrogressive process does not present anything characteristic.

In the mucous membrane of the nose the glanders tubercles or nodules are always plainest on the septum. They, too, vary in size from that of a pin's head to that of a pea, and project but little over the surface of the membrane, and are therefore sometimes scarcely visible. At a *post-mortem* examination, however, the same can be seen and felt more plainly, because then the mucous membrane is less succulent and swelled. Either singly or in groups they are imbedded in the mucous membrane, usually in the upper layer, and are distinguished from the reddened membrane by their gray, grayish-white, or grayish yellow color. Sometimes these tubercles, or glanders-nodules, are situated deeper, in the middle or lower layer of the mucosa, and therefore less distinctly circumscribed, and indicated only by a slight elevation above the surface of the membrane, but not by any distinct color. On a cut, however, the same can be seen very plainly. The substance of the glanders-nodules in the nose is more or less soft, and consists of round cells, free nuclei, spindle-shaped cells, and a fine connective intercellular substance. The spindle-shaped cells are lodged mostly side by side; some of them, the younger ones, are rather thin, and others are swelled in the middle, and are ripe and near breaking. The nodules or glanders-tubercles present usually a gray-yellowish color, if composed principally of round cells, and their color is somewhat indistinct if spindle-shaped cells constitute the prevailing element. The retrogressive metamorphosis consists in a decaying to a fatty or cheesy substance. A real shrinking and exsiccation and a deposit of lime-salts do not occur. Glanders nodules or tuber-

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cles in the cutis are a comparatively rare occurrence in horses, but are observed very often in human beings affected with glanders. As the skin of horses is coated with hair, only the larger tubercles or nodules will be noticed; the very small ones usually escape observation till the regressive process has been completed, and has changed them to small lenticular ulcers. Otherwise the morbid changes are the same as in the mucous membrane.

Miliary tubercles, finally, can also be found imbedded frequently in the morbidly increased connective tissue of the indurated submaxillary and other lymphatic glands. On a cut the same can frequently be pressed out of the surrounding tissue as small knots or nodules. An exsiccation is a frequent occurrence, but a deposit of lime-salts has not yet been observed.

Glanders-tumors, or very large nests of glanders-cells, can be found fully developed only in the lungs, but are even then not as frequent as the tubercles. They have their seat usually immediately beneath the pulmonal pleura, especially toward the lower sharp border of the lungs. In some cases, however, the same are also found imbedded in the pulmonal tissue, and are then not often numerous. The tumors, or glanders growths, are either distinctly limited, and varying in size from that of a cherry to that of an apple, or the same are more or less diffuse. The large tumors seem to be composed of two or more smaller ones which have increased in size till they have come in contact with each other and have united. The intermediate pulmonal tissue in such a case has disappeared. Large tumors thus produced are frequently of an irregular shape. The pulmonal tissue surrounding the gray or grayish-yellow tumors is at first hyperæmic, and the outlines of the latter are more or less indistinct, but afterwards the same become more defined. On a cut these tumors present an appearance somewhat similar to bacon. In some cases the same are more or less firm and solid, like a fibroid growth, and in others of the consistency of a sarcoma. Under the microscope the constituents are found to be essentially the same as those of the smaller nodules or tubercles. The round cells, however, vary much more in size. Some are very large and distinguished by their dark and granulated nuclei.

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Numerous epithelial mother-cells, containing nuclei and incipient cells, spindle-shaped cells in different stages of development, some, maybe, very much swelled or just breaking, and others decayed and discharging their granulated contents and large nuclei, and a connective intercellular substance which gives the whole tumor its continuity and a certain degree of solidity, constitute the principal components. The softer glanders-tumors, similar in consistency to a sarcoma, are composed mainly of round cells, while the firmer or more solid ones consist principally of spindle-shaped cells, and contain comparatively few round cells imbedded in the intercellular substance, which latter is here and there fibrous and solid, and thereby the cause of the greater firmness. The presence of both kinds of cells, spindle-shaped, and large round ones, proves that connective-tissue corpuscles, as well as epithelium elements, contribute to the formation of pulmonal glanders-tumors. The retrogressive metamorphosis proceeds, according to the observations of Gerlach, in two different ways. Sometimes all components of the glanders-tumor, the intercellular substance as well as the glanders-cells, undergo a process of decay which proceeds either from one center — if the tumor is a simple one — or from several centers simultaneously, if the tumor is a complicated one. In the former case the whole tumor is changed to one cavity with cheesy contents, but in the latter two or more larger or smaller cavities, corresponding to the number of the original tubercles or tumors, are produced. The contents of the same present also a cheesy appearance. Sometimes, however, the whole process is different. The round cells decay and are absorbed, and an excessive growth or production of connective tissue is taking place. The tumor becomes harder and firmer, and assumes finally the characteristics of a fibroid growth, which contains interspersed in its tissue a few round cells, and may not undergo any further changes for a long time. Such fibroid tumors correspond to the fibroid cicatrices which occur frequently in the mucous membrane of the septum, and are found not seldom if the morbid process has been a very slow or chronic one. If glanders is acute or complicated with other morbid processes which accelerate its progress, such hard and firm fibroid tumors

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or cicatrices are never formed. On the contrary, the glanders-tumors decay rapidly, often before the same have had time to assume definite shape and form.

Glanders-ulcers or abscesses are produced if the intercellular substance of the tubercles undergoes dissolution. Dissolved intercellular substance and decayed and decaying glanders-cells constitute the matter. The process is about as follows: —

Farcy-ulcers in the subcutaneous connective tissue. The development or the growth of a farcy-tumor is always attended with some local inflammation in the surrounding tissues. A violent proliferation begins in the center of the tumor, and numerous small round cells which can scarcely be discriminated from matter-corpuscles are produced. The inflammatory process furnishes a sufficient quantity of exudation to loosen and to envelop the round cells almost immediately after the same have been produced. Some white blood-corpuscles may become intermixed, but the same must be regarded as strangers, because a very large majority of the cells suspended in the fluid exudation are the product of the proliferous process. So it may happen that a farcy boil or tumor shows fluctuation, and contains matter within a few days, or is changed to an abscess much sooner than a common boil. The matter of a farcy ulcer does not exhibit any distinctive difference from other pus except in so far as it possesses infectious qualities. Almost as soon as a farcy-boil has been changed to an abscess, or contains matter, the nearest subcutaneous lymphatics commence to swell to plainly visible chords or strands, and in their course not seldom new boils are formed, which also undergo the same metamorphosis as the first one. Hence it happens very frequently that farcy boils and ulcers make their appearance in rows somewhat resembling strings of beads, which constitutes one of the characteristics of the disease. A little later the nearest lymphatic glands, too, commence to swell and to be changed to hard and more or less painful farcy-buboes. The circulation or the current of lymph in the lymphatics of such a swelled gland or glands becomes interrupted, and in consequence œdematous swellings make their appearance in the parts in which such an interruption has been effected, usually in a leg. The swelling

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of the lymphatics and of the lymphatic glands, the lymphatic abscesses, and the appearance of œdemata have led to mistakes; an inflammation of the lymphatics has been supposed to constitute the primary and the production of farcy-ulcers a secondary morbid process. Sometimes, it is true, it is rather difficult to find the primary boils or ulcers from which the morbid process has spread. The comparatively rapid dissemination of the glanders-virus through the lymphatics in the loose subcutaneous connective tissue explains why farcy usually spreads sooner over the whole body, and becomes fatal in much less time than either pulmonal or nasal glanders.

The products of the glanders-process, however, do not always present themselves as distinctly limited growths in form of nodules, tubercles, tumors, and boils. The morbid products in certain cases, especially in such in which an inflammatory exudation is taking place in the same parts in which the glanders-process has its seat, become diffuse, and the glanders-cells almost as soon as produced are carried off by the exudation. Gerlach discriminates two forms of diffuse glanders, viz., glanders-catarrh, and diffuse production of glanders-cells in the mucous membranes.

GLANDERS-CATARRH.

If the glanders-process makes its appearance in a mucous membrane, the first morbid changes and symptoms are always those of glanders, blended with a catarrhal affection. Consequently the first stage of nasal glanders may appropriately be called a "glanders-catarrh," and may under favorable circumstances exist almost unchanged for a long time without being attended by any other characteristic symptoms except perhaps some swelling of the submaxillary lymphatic glands (so-called nasal gleet). Afterward, in a more advanced stage of the disease, more characteristic morbid changes make their appearance, but the catarrhal discharge from the nose remains. In glanders-catarrh the secretions of the nasal mucous membrane differ only in so far from those observed in a common catarrh as they present frequently a greenish or green-yellowish color, and contain very soon epithelium-scales, and small, round glanders-cells sim-

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ilar to matter-corpuscles. With the appearance of the epithelium *debris*, however, the somewhat characteristic greenish color usually disappears. The glanders-cells have their source in the epithelium-producing layer of the mucosa, and develop from epithelium-cells, but are carried off or washed away by the fluid exudations. Still the discharge itself, although containing glanders-cells, offers no characteristic of great diagnostic value except its infectiousness, which exists from the very beginning. The microscope reveals no essential differences, neither between the nasal discharges in glanders and in catarrh nor between farcy matter and common pus.

GLANDERS-CELLS IN THE MUCOUS MEMBRANE.

The glanders-cells are not produced in certain limited spots or nests, but in diffusion over large parts of the mucous membrane. The latter appears swelled and loosened in its tissue, and contains larger or smaller numbers of round glanders-cells of different size. Afterwards an exuberant morbid growth of connective tissue makes its appearance, which causes the mucous membrane to become more or less thick and callous. If the glanders-process extends to the frontal and maxillary cavities, the naturally fine mucous membrane, especially of the latter, is usually found coated with a muco-purulent secretion, and presents more or less uneven swelling and degeneration, caused by an exuberant neoplastic production of connective-tissue elements. In the nasal cavity, but especially on the septum, the diffuse glanders-process penetrates not seldom the whole mucous membrane, and extends to the submucosa. Callous swellings are formed by an exuberant production of neoplastic elements of connective tissue, and within these swellings appear diffuse center-stations, or nests of round cells, which (latter) gradually undergo decay and are absorbed. Fibrous or scar tissue, which afterwards shrinks or contracts to a scar or cicatrix, takes their place. So it may happen that scars or cicatrices make their appearance without any ulceration having preceded. These scars or cicatrices usually contain a center, from which several whitish strands of fibrous tissue, produced by the same process, are radiating in different directions. Still, not every scar or cicatrix

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found on the mucous membrane of the septum has been produced in the same way, without any preceding ulceration. Under favorable circumstances a healing even of a glanders-ulcer will now and then be effected, but in such a case the scar left behind is usually less prominent or conspicuous, and is destitute of such long radiating strands of fibrous tissue.

GLANDERS-ULCERS.

The same, if present, constitute the most characteristic and unmistakable morbid change of the whole morbid process, and are found usually in the mucous membrane of the septum, especially toward the nasal bones, but also in the mucous membrane of the conchæ, the nasal ducts, the larynx, and the windpipe, and, in rare cases, in the cutis. Professor Gerlach says he has found ulcers in the mucosa of the throat and windpipe only in acute glanders. I remember one of chronic glanders that occurred in 1869 in Quincy, Ill., in which, at the *post-mortem* examination, numerous ulcers presented themselves in the nasal ducts and in the mucous membrane of the larynx and windpipe, but none on the septum. In that horse the only observable symptom consisted, for a long time, in difficulty of breathing, resembling a kind of roaring when exercised. The *post-mortem* examination, made by myself, revealed glanders in a very advanced stage of development, notwithstanding that the horse, a fine black roadster, was not suspected of being affected with glanders up to within two weeks before he was killed.

Glanders-ulcers are always preceded by glanders nodules or tubercles in the mucous membrane or skin, respectively, and are the product of a decay of the glanders-cells and a dissolution of the intercellular substance of those nodules or tubercles. The process, however, by which these ulcers are developed, is not always the same, but varies somewhat according to the size and situation of the tubercles. If the latter are large, of the size of a pea, and extend deep into the mucous membrane, a depression, which soon changes to a small hole, at first not larger than a pin's head, makes its appearance in the middle of the external surface. This hole, however, soon grows larger, and constitutes within a few days an ulcer corresponding in size to that of the

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former tubercle. The deeper the latter extends into the mucosa or submucosa, the deeper will also be the ulcer.

If the glanders-tubercles are very small and superficial, or, as it sometimes happens, visible only as gray specks or dots, the proceeding is a little different. At first the epithelium is cast off; a small, scarcely visible loss of substance takes place, which gives the incipient ulcer the appearance of a small erosion. In other cases the decayed, superficial part of the tubercle presents itself as a yellowish-gray mass, which remains for a short time coated with epithelium. The decaying tubercle, in such a case, has the appearance of a small pustule. In both cases, finally, small, flat, lenticular ulcers are formed, which, if numerous and close together, as frequently happens (glanders-tubercles, if very small, are usually situated close together in groups), become soon confluent, and present then one large, flat ulcer with an uneven bottom. A few days ago I had an opportunity to observe small lenticular, and one medium-sized confluent ulcer, on the right side of the septum of the nose of a former circus-horse that had been affected with glanders — had had discharges from the nose — for over eight months.

A glanders-ulcer once formed grows in depth and circumference as follows: At the bottom and on the borders of the ulcer, and also in the immediate neighborhood of the same, appear again gray specks and nodules (nests of round cells), which also undergo decay, become confluent with the ulcer, and increase thereby the size and depth of the latter. The bottom of a glanders-ulcer presents a grayish-yellow (bacon-like) appearance, marked with red blotches, and is composed mainly of round glanders-cells, the decay of which adds to the depth of the ulcer. Consequently, as after each decay new round cells make their appearance, a glanders-ulcer is not only able to work its way through the mucous membrane and its connective tissue, but also into and even through the cartilaginous septum and the osseous conchæ. This, however, takes place only in a very advanced stage of the disease, and under the influence of a complication with an inflammatory process. The bottom of a deep ulcer presents usually a dirty appearance, caused by decay or decomposition of tissue and blood. Growth of a glanders-

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ulcer in circumference is a very common occurrence. The process is usually a rapid one, if the ulcer is composed originally of small lenticular ulcers, so-called erosions, with corroded gray or inflamed and red borders. If two or more of such compound ulcers happen to be in close proximity to each other, the same very often become confluent in a comparatively short time, and present then one large ulcerating surface. In the cutis the ulceration process is exactly the same, and is invariably preceded by a formation of glanders-tubercles. The latter have their seat usually in the skin of the lips and nostrils, seldom in the skin of the legs and of other parts of the body. In the cutis, too, deep ulcers and flat and lenticular ones can be discriminated. In some cases the cutis-ulcers have a special tendency to increase in depth — if the preceding tubercles have been large — while in others a tendency to grow in circumference is prevailing. The latter is the case especially if the tubercles have been small and close together. Both kinds of ulcers, however, like those in the mucous membrane, produce abundant exudation and matter, a peculiarity by which deep glanders-ulcers situated in the skin are easily discriminated from farcy-ulcers or glanders-abscesses. Besides that, the latter are always kettle-shaped, have red and elevated borders, and are situated in the subcutaneous connective tissue, while the former have their seat in the skin.

THE CAUSES AND ORIGIN OF GLANDERS.

As to the causes and origin of glanders, opinions, especially in former times, have differed very widely. A great many veterinarians, particularly in France, and there until quite recently, denied its contagiousness altogether.

Even at the present day an auchtochthonous and a deuteropathic development, too, are looked upon as something possible, or even self-evident and of frequent occurrence, not only by non-professional men, but also by a great many veterinarians of high standing. As causes of auchtochthonous glanders, all possible injurious agencies have been accused, the same as in all other contagious diseases, such as pleuro-pneumonia of cattle, for instance, which latter, as is now more generally admit-

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ted, spreads, and is caused exclusively by infection or by means of the contagion. The principal causes of glanders have been considered spoiled, decayed, and insufficient food, or food of a bad quality or unsuitable composition; dirty, crowded, and ill-ventilated stables; overwork, hardships, and exposure of any kind or description; in short, nearly everything that is calculated to have an injurious effect upon the animal organism. A great many horses in every country and in every clime are exposed to some or to all of the injurious influences just enumerated, and there is not the least doubt that these influences are well able to weaken the constitution of an animal, to produce emaciation and debility, and to cause a whole army of more or less dangerous and frequently fatal diseases, but still glanders is not any more frequent among horses thus exposed and suffering than among others which are well kept and well treated in every respect. In every country and in every clime a larger or smaller number of horses are exposed to all those injuries mentioned, are worked to death, starved to death, suffocated to death in foul stable air, poisoned to death with spoiled food and with impure, stagnant water, and still there are countries in which glanders is an unknown, or, at least, an exceedingly rare disease, while in other countries in which horses, on an average, are not kept any worse, or, may be, are kept much better, glanders is a very frequent disease, and causes annually great losses. As a general rule, which, however, suffers apparent exceptions as I shall show hereafter, glanders is frequent in all those countries in which a great many horses are imported, and rare in all those countries in which more horses are raised than needed, or from which horses are exported. Besides that, nobody has ever succeeded in producing glanders by merely exposing or subjecting a horse that has never been exposed to the influence of glanders-contagion to any or to all the injurious agencies and influences which have been mentioned as being accused as the causes of protopathic glanders. In the West, where I have lived and practiced during the last thirteen years, glanders, as I have been informed by reliable persons, used to be an almost unknown disease before the civil war, but has been spread by

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condemned army horses during and immediately after the war, and is now frequent and can be found everywhere.

Among asses and mules glanders is comparatively not as frequent a disease as among horses, notwithstanding that the former have more predisposition, are easier and sooner infected, and succumb quicker.

In modern times, most veterinary writers, it seems, have abandoned the possibility of an autochthonous or idiopathic origin of glanders, but the deuteropathic development is yet upheld by a great many. The diseases supposed to terminate in glanders are especially strangles or distemper, influenza, catarrhal affections of the respiratory mucous membranes, and ulceration in various parts of the animal body. There can be no doubt that a great many cases of occult glanders (so-called nasal gleet) have been looked upon and treated as distemper, catarrh, influenza, etc., and afterwards, when plain symptoms of glanders made their appearance, it was more convenient all around to suppose that glanders had proceeded from the disease first diagnosticated, than to admit a diagnostic mistake. So with farcy. It undoubtedly has happened a great many times that the first symptoms of farcy have been mistaken for an inflammation of the lymphatics, and as farcy in its further course becomes frequently complicated with glanders, it is easy to conclude that an inflammation of the lymphatics constitutes a primary disease of glanders. Under certain circumstances I admit it is rather difficult to discriminate at once an inflammation of the lymphatics and subsequent ulceration or formation of abscesses from genuine farcy, and so mistakes, undoubtedly, have occurred.

Besides all that, the diseases looked upon as the possible progenitors of glanders are similar to the latter only in regard to a few external symptoms, but entirely different as far as the morbid process is concerned. They lack altogether, during their whole course, from first beginning to their final termination, the specific characteristics of glanders, and a conversion of any one of them into the latter disease must be looked upon as just as impossible as it is to change a cow to a horse, or a goat to a hog. Still, this does not exclude the possibility of an animal affected

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with one of those disorders, or with any other disease, becoming infected with glanders or farcy. On the contrary, a diseased condition of the respiratory mucous membranes seems to facilitate an infection if an exposure to glanders-contagion is taking place. At any rate, the morbid process of glanders is always much more violent and makes a more rapid progress in a diseased organism than in one that is otherwise perfectly healthy. To get at the bottom of the facts and to guard against mistakes, it will be necessary never to lose sight of the specific characteristics of the glanders-process.

Notwithstanding all those cases of apparent deuteropathic development of glanders which can be found in the veterinary literature of nearly every country, I am not afraid to say I do not believe that a case of real deuteropathic glanders, one that can stand a thorough and unbiased investigation, has ever occurred. Gerlach, in his treatise, repeatedly mentioned, says, "A genuine development (protopathic and deuteropathic) must be considered as not proved."

Glanders, as well as pleuro-pneumonia, Russian cattle-plague, and scab and mange, will cease to exist if a propagation by means of infection is made impossible. If, for instance, within the limits of the United States, all animals affected with glanders were destroyed at once, and at the same time every place where glanders contagion may be existing were thoroughly disinfected, and if any importation of glandered horses or of the contagion were successfully prohibited or prevented, glanders would at once become extinct, and would never make its appearance again within the limits of the United States, unless imported again from other countries. It is a disease that can be eradicated.

I said before that glanders is most frequent in those countries in which numerous horses are imported from other countries. This is an undeniable fact except in regard to those commonwealths in which good veterinary schools provide a sufficient number of thoroughly educated veterinary surgeons, and in which stringent laws enforce the immediate destruction of every animal affected with glanders, prohibit veterinary quackery, and do not allow anybody to keep or to treat a glandered animal

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unless he is a qualified veterinary surgeon, and gives sufficient bonds to pay possible damages.

I know very well that I shall be contradicted, but mere denials, or questions asking where glanders originally comes from if a spontaneous development does not take place, will not do. Such questions, of course, I cannot answer. When Gerlach first pronounced pleuro-pneumonia of cattle a pure contagion, that is, a disease propagated exclusively by means of infection, Professor Spinola asked pertly if Gerlach had imported pleuro-pneumonia from the moon, but failed utterly — and everybody else, too — to show a solitary case of an unmistakable and well-authenticated spontaneous development. If any one can show me a case of spontaneous glanders, not caused by infection, or give satisfactory and unmistakable proof that a protopathic or deuteropathic development of glanders has occurred, I will take back what I have said, but not before.

THE CONTAGION.

Contagion must be considered the exclusive cause of glanders. The contagious principle is developed during the very first stages of the disease, and even before plain symptoms have made their appearance. It exists most concentrated in the immediate products of the morbid process, but especially in the discharges from the nose, and in the contents of the glanders and farcy ulcers. It is present also in all the secretions and excretions of the affected animals, as has been proved by numerous direct experiments. Professor Gerlach, in order to ascertain if the contagion is contained not only in the fluid animal humors and excretions, and in the fluid and solid products of the morbid process, but also in the pulmonal exhalation and in the perspiration, has made several interesting experiments, and has found that an inoculation of a healthy horse with artificially condensed exhalation and perspiration of a glandered animal produces the disease. He has, however, not succeeded in communicating glanders by injecting defibrinated blood of glandered horses (100 and 200 grains respectively) into the veins of healthy animals. Still, the contagiousness of the blood was established long ago.

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The experiments of Gerlach and of others, and numerous clinical observations, too, have proved beyond a doubt that the contagion contained in the exhalation and perspiration clings, though only in small quantities, to the aqueous vapors exhaled by the respiratory organs and perspired by the skin. The contagious principle, therefore, is volatile only in a limited degree, and to produce an infection by means of the exhalation and perspiration at a distance of several feet requires usually some length of time. So it happens very often that a horse occupying with a glandered horse the same stable, but not the same stall, remains exempted. The more forcible and accelerated the breathing and the more abundant the perspiration of the horse affected with glanders, the greater, it seems, is the danger of an infection of healthy horses that are near or occupy the same stable.

Another question not easily answered, and yet an object for investigation, may be asked; that is, Do organic forms constitute the contagion? is the contagious principle bound on, or inseparable from, organic forms? or is its action merely a chemical one? On this question the opinions of the best authorities differ. Professor Gerlach, in his successful experiments with condensed exhalation and perspiration, found no organic forms whatever in the perfectly limpid drops; further, he found no organic forms in the very infectious caseous substances taken from the mucous membrane of a horse affected with diphtheritic glanders. He, therefore, has come to the conclusion that the glanders-contagion does not consist in, nor is bound on, organic forms, and that the action of the contagious principle must be a chemical one. On the other hand, Hallier and others have found organic growth (micrococci) in the humors of glandered horses and in the products of the morbid process of glanders, and are inclined to consider the micrococci as the agency which causes the disease, produces the morbid changes, and effects a communication of the glandered process to other healthy animals. If Hallier and others are right, a great many mysterious phenomena observed in glanders find an explanation; but if Gerlach's observations are correct, Hallier's theories necessarily fall to the ground. Gerlach says: "Hallier finds everywhere fungi,"

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and Chauveau finds everywhere cells. Still, notwithstanding my high regard for Gerlach and the thoroughness of his investigations, I think the finds of Hallier and of other investigators cannot be discarded; positive evidence is always of more value than negative proof.

The glanders-contagion, whatever its nature may be, communicates glanders and farcy, not only to the animals belonging to the genus *equus*, but also to other animals and to man. Numerous cases are reported every year in the periodical veterinary literature. The only domesticated animal that seems to be exempted, or to be destitute of any predisposition, is the ox.

Glandered horses, as soon as the disease has been diagnosticated, are usually removed to the cow-stable, or to pens or places where cattle are kept, and still no case, as far as I have been able to learn, is on record in which an ox or a cow has contracted the disease. Sheep are easily infected. Goats, too, possess sufficient predisposition. Ercolani described a case, and Wirth succeeded in communicating glanders to a male goat by means of inoculation. Hogs seem to possess but little predisposition, and cases of dogs becoming infected and dying of glanders have been communicated by Nordstroem and Langeron. Several cases are on record in which wild animals, lions especially, have become infected with glanders by being fed with meat of glandered horses. According to the experiments of Viborg and Bingheim, the flesh of a horse affected with glanders can be eaten without danger of infection if properly cooked or fried.

One important phenomenon must be mentioned, and that is, that glanders always becomes a frequent disease after any great war. Such was the case in our own country after the great civil war, as I have mentioned before, and also in Germany and France, but especially in the latter country, after the war of 1870–71. Cases of glanders will also be frequent during the next few years in the Turkish Empire, and in those Turkish provinces which have become independent, when separated from the Ottoman territories. The cause of this frequency is an obvious one. It consists in the abundant opportunity of infection. One horse affected with (occult) glanders in either of the hostile armies can, for obvious reasons, communicate the disease with

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the greatest facility to a large number of animals. The fact of glanders becoming frequent after each large war has been used very frequently as an argument in favor of a protopathic development, but if it is looked upon in a proper light it proves, if anything, the exclusive spreading of the disease by means of the contagion.

PREVENTION AND TREATMENT.

As to a medical treatment, there is scarcely a remedy known in the whole materia medica that has not been used against glanders, but, so far at least, with very poor success. It is true a great many *pretended* cures are on record. But if the slow or chronic progress of the morbid process, its frequent remissions in warm and dry weather, exacerbations in rough, cold, and inclement weather and in a foul atmosphere, and the great confusion that has prevailed in regard to the true nature of glanders, are taken into consideration, it is no wonder that mistakes and deceptions have occurred. Some of the cases that are said to have been cured have been no glanders at all, and in others the pretended cures have been only temporary — a mere remission. *Confirmed glanders must be considered as incurable;* and it would, therefore, be for the benefit of every one if our general government (Congress) would enact a law which should make it a criminal offense to keep and to use a horse, or any other animal, known to be affected with glanders. Any attempt to cure should also be strictly forbidden, because a prompt and immediate destruction of every animal affected with glanders, a disease which spreads only by means of its contagion, constitutes the best, surest, and cheapest, and in fact the only prevention.

A successful prevention of glanders is possible only if the contagion — which, even if it should not constitute the sole and only cause of the disease, causes at least nine hundred and ninety-nine cases of one thousand — is thoroughly destroyed wherever it may exist or wherever it may be found. Consequently every animal affected with glanders should be killed as soon as the nature of the disease becomes known, and be buried sufficiently deep or be cremated. But as the contagion adheres frequently also to the stables, — manger, floor, partition, etc.,—

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that have been occupied, the stable utensils, — brush, curry-comb, etc., and the harness, blankets, halters, bridles, saddles, etc., — that have been used or been in contact with glandered horses, it is of great importance to know what will best and most effectually destroy the contagion. Professor Gerlach has made very interesting and valuable experiments, to relate which, however, would lead too far. I will therefore only state the results arrived at. The discharges from the nose, glanders-matter, etc., lose their infectiousness if perfectly dried by being exposed to currents of air or to the rays of the sun; but kept moist, for instance in a damp cellar, wrapped up in a moist rag, or adhering to the corners of the manger, to a damp wall or floor, or to the bedding or the manure, etc., the contagion seems to possess great vitality, and may remain effective for half a year or longer. Putrefaction does not destroy the contagious principle. Chlorine destroys the contagion, and is therefore a very efficient disinfectant, provided the chlorides used come in actual contact with the contagion. A brief exposure of the infectious substances, nasal discharges, glanders-matter, etc., to the influence of chlorine in a gaseous state, mixed with the atmosphere, is ineffective. As a remedy to be given internally, chlorine, in shape of chlorine-water, for obvious reasons cannot be used; chemical combinations will be effected before an absorption can take place. The best and surest destroyer of the glanders-contagion is carbolic acid. It may be used not only as a disinfectant or for the purpose of destroying the contagion clinging to the wood-work of the stable, etc., but also in incipient cases of farcy, and in cases in which an infection with glanders-matter has just taken place in a wound, for instance, as a local remedy. If applied to the glanders-ulcers on the septum, or to farcy-ulcers, a tendency to heal will make its appearance. As a disinfectant, a solution of carbolic acid in glycerine or alcohol and water (1:1 or 2:20) is perfectly strong enough to be effective. Old straw, hay, and bedding must be burned, and blankets, etc., are best disinfected by exposing the same for some time to a temperature of 212° F., or higher, either in an oven or in boiling hot water.

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As to a therapeutic treatment only a few words will be necessary. Some of the most heroic medicines have been used with very doubtful results. So, for instance, Professor Ercolani, in Turin, claims to have had good success with arsenate of strychnine, but others who have made the same experiments have had no success whatever. In former times cantharides were considered as a remedy, but later investigations have proved them to be perfectly worthless. That every kind of mercurial combination and a great many 'sure-cure nostrums have been used and been advertised as specific remedies, as in every other incurable disease, is too self-evident to need any further mentioning.

The only rational treatment of a horse or other animal affected with glanders consists in a proper and effective application, in the right place, of either half an ounce of lead or five inches of steel; and until such treatment is invariably adopted, or made compulsory, there will be no prospect whatever of freeing this country from this loathsome disease, dangerous even to man, in whom, if once infected, it is just as incurable as in horses.

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PATRONS OF HUSBANDRY.

80

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STATE GRANGE.

1879–80.

GEORGE A. WASON, New Boston, *Master.*
FRANK L. TAYLOR, Danbury, *Overseer.*
JOHN D. LYMAN, Exeter, *Lecturer.*
G. A. SPAFFORD, West Chesterfield, *Steward.*
E. C. HUTCHINSON, Milford, *Assistant Steward.*
ISAIAH WHEELER, Temple, *Chaplain.*
EDWARD OSGOOD, Canterbury, *Treasurer.*
WILLIAM H. STINSON, Dunbarton, *Secretary.*
FRANK H. WELD, Cornish, *Gatekeeper.*
MRS. G. A. WASON, New Boston, *Ceres.*
MRS. G. A. SPAFFORD, West Chesterfield, *Pomona.*
MRS. JOHN GAGE, Henniker, *Flora.*
MRS. FRANK W. MILLER, Portsmouth, *Lady Assistant Steward.*

EXECUTIVE COMMITTEE.

GEORGE A. WASON, New Boston.
DUDLEY T. CHASE, Claremont.
ISAAC STORY, Hopkinton.
STEPHEN C. PATTEE, Warner.

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LIST OF SUBORDINATE GRANGES.

No.	Name.	Location.	Names of Officers.	Offices.
1	Gilman	Exeter	John J. Bell	Master.
			Charles N. Healey	Secretary.
			Hezekiah Scammon	Business Agent.
3	Amoskeag	Manchester	Ignatius T. Webster	Master.
			Isaac Huse, Jr	Secretary.
4	Merrimack River	Canterbury	Charles F. Morrill	Master.
			Miss L. Maria Mason	Secretary.
5	Lovell	East Washington	John Wood	Master.
			W. J. Powers	Secretary.
6	Halestown	Weare	A. B. Johnson	Master.
			Benjamin T. Jameson	Secretary.
			Daniel Hanson	Business Agent.
7	Granite	Milford	E. C. Hutchinson	Master.
			Miss Clara J. Towne	Secretary.
			Alonzo W. Howard	Business Agent.
8	Sullivan	Newport	Charles A. Silsby	Master.
			Fred S. Little	Secretary.
			L. L. Cutts	Business Agent.
9	Claremont	Claremont	Dudley T. Chase	Master.
			Adam R. Leet	Secretary.
10	Souhegan	Amherst	James G. Haseltine	Master.
			James F. Weston	Secretary.
11	Hudson	Hudson	Tyler Thomas	Master.
			Aldon E. Cummings	Secretary.
			James B. Merrill	Business Agent.
12	Hollis	Hollis	Enos E. Homan	Master.
			Charles E. Hardy	Secretary.
			Enos E. Homan	Business Agent.
13	Nashua	Nashua	C. W. Murch	Master.
			Amos Fletcher	Secretary.
			Alfred Chase	Business Agent.
14	Mountain	East Concord	R. E. S. Wells	Secretary.
15	Hampton Falls	Hampton Falls	Levi E. Lane	Master.
			Annie S. Wadleigh	Secretary.
			J. D. Brown	Business Agent.
16	Hooksett	Hooksett	Gen. Natt Head	Master.
17	Ashland	Ashland	J. F. Keyes	Master.
			Paul Perkins	Secretary.
18	Pinnacle	Lyndeborough	Benjamin G. Herrick	Master.
			John H. Goodrich	Secretary.
			Charles F. Tarbell	Business Agent.
19	Cold River	South Acworth	Freeman E. Brackett	Master.
			Justin B. Crossett	Secretary.
			Isaac Newton	Business Agent.
20	Advance	Wilton	George L. Dascombe	Master.
			A. Dwight Abbott	Secretary.
			George H. Keyes	Business Agent.
21	Prospect	Mont Vernon	John M. Fox	Master.
			Miss Carrie F. Averill	Secretary.
			Clark Campbell	Business Agent.
22	Portsmouth	Portsmouth	Frank W. Miller	Master.
			Charles B. Mason	Secretary.
			Charles B. Mason	Business Agent.
23	Greenfield	Greenfield	Daniel W. Burnham	Master.
			Alfred W. Savage	Secretary.
			Alfred N. Hardy	Business Agent.

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LIST OF SUBORDINATE GRANGES, — *Continued.*

No.	Name.	Location.	Names of Officers.	Offices.
25	Cornish	Cornish	William Balloch	Master.
			Frank H. Weld	Secretary.
26	Columbia	Columbia	James B. Colby	Master.
			Enoch R. Kelsea	Secretary.
			Enoch R. Kelsea	Business Agent.
27	North Star	Stewartstown	E. W. Drew	Master.
			John C. Poor	Secretary.
			Milton Blodgett	Business Agent.
28	Mohawk	Colebrook	Arthur T. Holbrook	Master.
			S. B. Whittemore	Secretary.
29	North Haverhill	North Haverhill	Henry P. Watson	Master.
			Ida M. Hunt	Secretary.
30	Grantham	North Grantham	Lyman B. Hayward	Master.
			A. W. Flanders	Secretary.
			John S. Clement	Business Agent.
31	Thornton	Merrimack	George W. Moulton	Master.
			W. J. A. Kittredge	Secretary.
32	Oak Hill	Francestown	E. W. Colburn	Master.
			I. B. Farnum	Secretary.
			I. B. Farnum	Business Agent.
33	John Hancock	Hancock	Alden S. Wood	Master.
			Adolphus G. Foster	Secretary.
34	Miller	Temple	James E. Burton	Master.
			Nahum A. Child	Secretary.
			Isaiah Wheeler, James E. Burton, George F. Barker,	Business Agt's.
35	Peterborough	Peterborough	Timothy N. Hunt	Master.
			Henry Field	Secretary.
			M. L. Morrison	Business Agent.
37	Nutfield	Derry	Joseph R. Clark	Master.
			Edward L. Jones	Secretary.
			Jacob S. Couch	Business Agent.
38	Plainfield	Plainfield	O. B. Williams	Master.
			B. F. Ward	Secretary.
39	Bear Hill	Henniker	James Wilkins	Master.
			Mrs. Charlotte I. Rice	Secretary.
40	Uncanoonuc	Goffstown	George Pattee	Master.
			Calvin Martin	Secretary.
			G. P. Henry	Business Agent.
41	Wolf Hill	Deering	Matthew Forsaith	Master.
			Mrs. Calista J. Wilkins	Secretary.
			Alvin Tubbs	Business Agent.
42	Stark	Dunbarton	John C. Mills	Master.
			Daniel Jameson	Secretary.
			T. W. Kimball	Business Agent.
43	Ball Mountain	Stratford	Gerry W. Johnson	Master.
			William R. Brown	Secretary.
44	Londonderry	Londonderry	Daniel G. Annis	Master.
			Miss Sarah E. Clark	Secretary.
			Daniel G. Annis	Business Agent.
45	No. Four Grange	North Charlestown	Mervin J. Whipple	Master.
			Helen W. Jenney	Secretary.
			Henry K. Jenney	Business Agent.
46	Narragansett	Bedford	Hugh R. Barnard	Master.
			George H. Wiggin	Secretary.

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LIST OF SUBORDINATE GRANGES, — *Continued.*

No.	Name.	Location.	Names of Officers.	Offices.
47	Warren Pond	Alstead	S. A. Mitchell	Master.
			Myron D. Clark	Secretary.
			Myron D. Clark	Business Agent.
48	Lancaster	Lancaster	Zeb Twitchell	Master.
			Mrs. Ella J. Hartford	Secretary.
			George H. Watson	Business Agent.
49	Monroe	Monroe	Church M. Paddleford	Master.
			D. F. Blodgett	Secretary.
			Edward Emery	Business Agent.
50	White Mountain	Littleton	Abijah Allen	Master.
			Charles W. Bedell	Secretary.
			Noah Farr	Business Agent.
51	Winnipesaukee	Meredith	John Dearborn	Master.
			D. W. Coe	Secretary.
			John Dearborn	Business Agent.
52	Mont Belknap	Gilford	George W. Morrill	Master.
			J. Ralph Hatch	Secretary.
			Jewell Gove	Business Agent.
53	Joe English	New Boston	William Woodbury	Master.
			Moses A. Dane	Secretary.
			T. R. Cochrane	Business Agent.
54	Wyoming	South Weare	Almon L. Sleeper	Master.
			Mrs. Sarah E. Philbrick	Secretary.
55	Ammonoosuc	Bath	A. P. Prescott	Master.
			Mrs. A. P. Prescott	Secretary.
56	Union	Hopkinton	Charles Gould	Master.
			Isaac Story	Secretary.
58	Bradford	Bradford	Charles Ripley	Master.
			Walter P. Melvin	Secretary.
59	Union	Orford	Asa S. Rhodes	Master.
			Edwin Bugbee	Secretary.
			Benjamin Morrill	Business Agent.
61	Palmer	Piermont	L. E. Risley	Master.
			B. C. Metcalf	Secretary.
			Roswell Hunt	Business Agent.
62	Morning Star	Lyme	F. B. Palmer	Master.
			J. F. Elliott	Secretary.
63	Valley	Hillsborough	Jesse F. Bailey	Master.
			John Goodell	Secretary.
			David B. Burbank	Business Agent.
64	Lafayette	Franconia	Leonard Boles	Master.
			Ivory H. Glovier	Secretary.
			Ivory H. Glovier	Business Agent.
65	Crown Point	Strafford Corner	Freeman Varney	Master.
			Dana R. Berry	Secretary.
			Dana R. Berry	Business Agent.
66	Excelsior	West Rumney	Vernon E. Atwood	Master.
			James Smart	Secretary.
			Burgess A. Hall	Business Agent.
67	Cardigan	Alexandria	John F. Vose	Master.
			Levi F. Blake	Secretary.
			Edwin C. Merrill	Business Agent.
68	Mascoma	Enfield	Levi F. Webster	Master.
			Henry H. Wilson	Secretary.
			Nathan S. Holt	Business Agent.
69	Eureka	Grafton Center	Albert B. Stevens	Master.
			B. Frank Williams	Secretary.
			Joseph B. Page	Business Agent.
70	Mont Calm	Enfield Center	Charles McDaniel	Master.
			J. A. Little	Secretary.
			Charles McDaniel, J. A. Little,	Business Agt's.

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LIST OF SUBORDINATE GRANGES, — *Continued.*

No.	Name.	Location.	Names of Officers.	Offices.
71	Blazing Star.....	Danbury.....	Willis A. Tucker.....	Master.
			Sarah J. Perkins.....	Secretary.
			Adoniram J. Danforth...	Business Agent.
72	Indian River.....	Canaan.....	Alvin Davis.....	Master.
			John Fernald.....	Secretary.
			John Fernald.....	Business Agent.
73	Golden.	Lisbon	Daniel W. Cooley.....	Master.
			Albert F. McConnell....	Secretary.
74	Deerfield.....	Deerfield	L. R. Philbrick..... ...	Master.
			J. F. Prescott.....	Secretary.
76	Barrington.....	Barrington.....	Thomas W. Hale.....	Master.
			Jonathan R. Drew.....	Secretary.
77	Mount Hope.....	Landaff....	John E. Hall.....	Master.
			Mrs. H. A. Quimby.....	Secretary.
79	Olive Branch.....	Hebron.....	E. K. Follansbee.....	Master.
			William C. Ross.....	Secretary.
80	Bow Lake.....	Strafford.....	John O. Boody.....	Master.
			Seth W. Caverly.....	Secretary.
			Seth W. Caverly.....	Business Agent.
81	Cocheco	Rochester.....	Martin L. Lord.....	Master.
			Minnie F. Hayes.....	Secretary.
			William T. Wentworth..	Business Agent.
82	Newfound.....	Bristol.....	Frederick Kidder.....	Master.
			Mrs. Ruth F. Pray.....	Secretary.
83	Spafford..	West Chesterfield....	Oscar E. Sargent.....	Master.
			Warren W. Farr.....	Secretary.
85	Northwood.....	Northwood.....	Freeman J. Smith.....	Master.
			Mrs. V. P. Tasker.....	Secretary.
			Nathan E. Cate.....	Business Agent.
86	Rochester.....	Rochester.....	Isaac W. Springfield.....	Master.
			Dudley B. Waldron.....	Secretary.
			George D. Nowell.....	Business Agent.
87	Kearsarge	Wilmot.....	Horace Pedrick.....	Master.
			Minot Stearns.....	Secretary.
			James O. Buswell.....	Business Agent.
88	Highland Lake....	East Andover.....	Nahum J. Bachelder.....	Master.
			Henry M. Bosworth.....	Secretary.
			Elvin B. Merrill.....	Business Agent.
89	Croydon.....	Croydon.....	Francis Dodge.....	Master.
			Sullivan Barton.....	Secretary.
			Frederick Barton.....	Business Agent.
90	Warner.....	Warner..... ...	Stephen C. Pattee.....	Master.
			George Q. Pattee.....	Secretary.
			Phillip C. Wheeler.....	Business Agent.
91	Sutton.....	Sutton.....	Charles A. Fowler.....	Master.
			Mrs. L. A. W. Chadwick.	Secretary.
			Frank G. Nelson.....	Business Agent.
92	Prospect Mountain	Plymouth.....	Daniel W. Grant.....	Master.
			Richard G. Stearns.....	Secretary.
93	Campton.....	Campton.....	Thomas S. Pulsifer.....	Master.
			Davis B. Keniston.....	Secretary.

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GRANGE PAPERS.

HOW TO IMPROVE FARMS.

BY HILLSBOROUGH COUNTY COUNCIL. — KIMBALL WEBSTER, REPORTER.

HENRY GRAY, lecturer of Advance Grange, said: The subject is a broad and important one, and requires study and thought. Farmers do not always keep in view the improvement of their farms. They should think, and when they do this, they *will* improve. We must farm cheap, and save all we can on the farm. We should have barn-cellars for manure. It is foolish to buy fertilizers, and throw manure outside to waste, as many do. The loss by exposure is one-half. We cannot afford to buy commercial fertilizers to improve our farms. Many spread manure over too much surface, and others feed their mowing short in the fall; and there is a loss in either case. We should cultivate the land thoroughly, manure liberally, and whatever crops we raise, always keep in view the improvement of the soil.

B. F. Hutchinson. — Location and circumstances are so different that no one method will apply to all. We must *think;* and farmers must enrich and improve their farms with brains. Where can we get a sufficient supply? I know a young man who bought a run-down farm in Lyndeborough, covered with bushes, stones, and old walls, and the land subject to wash badly. He has cleared the pastures and fields of bushes; dug ditches, and filled them with the old walls and stones, thus carrying away the surface water and preventing its washing; kept all the cows he could, — and he has improved his farm. We should labor to

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improve our farms for the love of it, and not altogether for money.

The ladies cultivate flowers, and adorn the walls of their houses with pictures, and there is no money in it; but they do it for their love of beauty. Modern houses are constructed and furnished to satisfy the love of beauty; and we should cultivate our crops because we love to see them grow, and not altogether to get rich. To enrich our farms, we should keep stock. I have been somewhat disappointed in the composition of barn manure. By chemical analysis, a cord of good manure has commercial value, in fertilizing material, of $7.21, and a ton of good hay represents the value of $7. This shows that it will not pay to sell hay and buy commercial fertilizers.

Enos E. Homan, of Hollis. — There is a class of farmers who labor under the difficulty of having no money with which to improve their farms; and such must depend upon hard labor, and should apply their labor with view to improvement. With us, the leading crop is grass; and without this, civilization could not exist. This is the great essential crop, to which we must look for success and improvement. We should return to the soil as much as we take from it, and this may be done to some extent with commercial fertilizers, after saving all we can upon the farm. I cannot farm to my satisfaction without buying something in the way of fertilizers. Last year I raised some onions, which were grown with phosphates, applied at rate of seven hundred to one thousand pounds per acre, and I had a good crop. When we use phosphates or chemical manures, we should apply double the quantity recommended by the manufacturers.

J. H. Woodward of Hudson said if he was asked the question, he should say, raise corn, clover, pease, and such crops as draw nutriment largely from the air and subsoil, and feed them to stock. Corn takes much from the atmosphere, and only about one-tenth from the soil; clover draws upon the subsoil and atmosphere, and pease from the atmosphere; and in raising and feeding these crops, we return much more fertilizing matter to the soil than is taken from it. A ton of straw contains but about one-eighteenth as much fertilizing matter as a ton of hay.

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We should sell straw, beef, pork, butter, cheese, and eggs. The loss of fertilizers in feeding hay is about forty per cent. In Canada they raise pease among the thistles, and cut together they make good fodder.

Col. Clough said at Manchester that corn as a fertilizing crop is worth three times as much as grass. Mr. Woodward said he commenced farming about fifteen years ago, and he knew a young man who had been farming about five years, and observed that he had improved his farm very much; had sold hay every year, and bought but little manure, and he found that this man raised considerable corn and clover, and some potatoes. Said he referred to Brother Webster, and would call upon him.

Kimball Webster said he made no pretence of being very much of a farmer; had been so situated that he could not give it the attention it demands. Said he had always sold more or less hay, and bought some manure and other fertilizers, but not very extensively. Said clover was the most profitable crop a farmer could raise, all things considered. It takes much of its nutriment from the subsoil and atmosphere, and is much richer in fertilizing material than any other hay; it contains all the necessary ingredients for growth and sustenance of animals, and will keep them in a healthy condition; it is rich in milk, and after being fed and returned to the soil, we have replaced much more than has been taken from it. Said he would feed some other hay; but in his experience of more than twenty years, he has fed much clover, and never has had a diseased animal, and would sell any other hay at a less price than clover. He said that it should be cut early, usually at about the middle of June, before the blossoms begin to turn brown, and cut the second time. If both crops are taken off in good season, and it is not fed in the fall, it will remain in the ground, under favorable circumstances, for several years. Mowing should not be fed in the fall. It is much better to mow the second time with the machine, and feed in the barn. If the crop is not large enough to mow, it should be left upon the ground, and where there is some clover it will seed and remain in the soil, and we always have more or less clover upon land which has been seeded down for

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several years. As crops to raise and feed on the farm, he would place clover first and corn second.

B. F. Hutchinson said he mows two crops from some of his mowing, and some years from all. He said clover hay was good for nutrition, but we should have something else for fat, and that it was a good plan to mix it with rye or oat straw.

G. W. Moulton of Merrimack said he would suggest that a committee be appointed in this organization, to make experiments for the farmers; and these should be exact, and not confined to standard crops alone, but to growing of all crops. Progress is the watchword for farmers, and they *are* progressing, but there are some who live and die poor farmers. The day has passed when a good constitution and two strong hands were the only requisites for a good farmer. Science has come to the farmer's aid, but she cannot do it all.

W. W. Howard said he thought the best system is to have plenty of brains, money, and a good wife, and to invest all the surplus funds in the farm, and it will eventually come back. The milk business is of much importance in this vicinity, and we should stand together as a band of brothers. The other party is banded together, and why should not we be? We don't want an exorbitant price, but only what is right; and if we stand together, we shall get our rights, not in this alone, but in other matters.

B. F. Hutchinson said he wanted the milk-producers to stand together, so that if one was touched, it would be felt by all.

George Buss of Wilton said that one matter often neglected was to take away the cold water first. He had had some practical experience in this matter, and had put in about five hundred rods of underdrains, and has raised his largest corn-crops from land that was nearly worthless before drained. It has paid, and he takes pleasure in making these improvements. It should be well done, and it will be permanent. He gets two crops of grass from this land every year, and the heaviest crop of fodder-corn he ever saw was grown upon it. A part of it was meadow with mud two feet deep, and a part was very thin, underlaid with blue sand, hard and loose beneath. All cold, springy land should first be drained, and then cultivated well. Said he used

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some phosphate and Stockbridge fertilizers, but we should depend chiefly upon that made upon the farm. He could better show upon his farm how his improvements were made, than describe them.

G. W. Moulton says that draining is the first thing to be done, and Brother B. hits the nail on the head. Some thirteen years ago I bought a farm of about sixty acres, much of which was covered with cold water and grown up to bushes. My neighbors pitied me. I cut hay to keep one cow. I have put in from five hundred to eight hundred rods of drains, and can now keep about twelve cows. The land is not frosty; cold water makes land frosty. I would plant potatoes for the first crop. The soil is similar to that described by Brother Buss, being underlaid with sand, and I have dug potatoes out of this sand weighing a pound apiece.

J. H. Woodward described his method of putting in cement drains. Said he put in a three-inch drain for a neighbor last fall, at cost of twenty-one cents per rod for cement. He makes holes in the pipe with an awl. He has some two-inch drains upon his land, which is clay, and they work to his satisfaction, and discharge water freely in a wet time. The expense for cement for two-inch drain is about three-quarters of a cent per foot. He thinks it is better than tile, and would use it instead of stone.

A. D. Abbott of Wilton said it was a matter of great importance to clear our fields of stones, and that there was no work upon the farm which he liked any better than draining and clearing the fields from stones. These improvements were permanent and would last a lifetime, and we make our fields smooth and improve our wet land at the same time. There is a great saving in getting the stones together in the fall, and drawing them on a drag, on the first snow, when the weather is cool, and the farmer is not hurried with other work. All these improvements add to our capital.

Brother Webb of Wilton said he heard it said that there was no fruit-tree that required drainage so much as the cherry.

Isaiah Wheeler of Temple said he came to learn, but had been somewhat disappointed. He supposed some Brothers

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would have a system. One says brains, another clover, another corn, and another a wife. Said he never heard of that before. No one system will do for all. Drainage has been advocated by some. He said that some fifteen or twenty years since, this was much talked of among farmers, and he had taken the fever at that time. His land is flat, cold, and backward in the spring. He drained one acre thoroughly with drains two rods apart, and was disappointed in the result. The other part of the field was equally as wet, and was not underdrained, and the crops were as good as upon the drained portion. The land is clay, and water would stand upon the surface a week, directly over the drains. He would not give a cent to have his land underdrained, only to get rid of stones. The land is not springy. He thought the only reliable system to be hard work and common sense, and farmers have a good share of this. Hard labor is as necessary now as ever. Said he labored hard in his younger days, and had hoped the time would come when he might lay aside hard work; and he thought it had come when the Stockbridge fertilizer was introduced. He said he used it, and it did all that was claimed for it. He got a good crop of corn, but the land was not improved. Think it was a damage to it. Machinery helps us some, but he thinks improvements must come from hard labor and by manufacturing all the manure possible on the farm. If milk or other products are sold, fertilizers must be brought back. He said, don't put money into the savings-banks, and lie awake nights for fear of loss, but invest it in cattle and on the farm.

FARM BUILDINGS.

BY HUDSON GRANGE. — KIMBALL WEBSTER, REPORTER.

The location of a set of farm buildings is the point first to be considered, and one which in many instances demands much thought and forecast. For, however convenient, and well arranged and constructed in all other respects, — if in a bad location, they will never prove fully satisfactory to the farmer who

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builds them, or to his successors; and the market value of the farm upon which the buildings are poorly located, is less, in proportion to the inconvenience or other defect in the location.

Owing to diversity of contour, location of roads, and many other varying circumstances, no definite rules can be made to apply to all cases. For convenience, and to save time and labor, in going to and from work, and the cartage of crops and manure, they should be as central as the circumstances will admit. They should not be upon hills much elevated above the tillage land — in cold, bleak positions, and inconvenient of access, neither in low valleys, near stagnant swamps or meadows, where the atmosphere is impure and unhealthy. If possible a slight elevation should be selected, where good drainage may be had, with a southern exposure, overlooking the cultivated fields and gardens, affording a view of the growing crops; and if running water can be obtained, it will be a great convenience, and save much time and labor.

Wet cellars should always be avoided, not only for the inconvenience and loss which in many instances they occasion, but also, and which is of more importance, for the unhealthy atmosphere which they create, and the numerous diseases which they engender. The safer and better plan is to place the buildings at a suitable height to insure a dry, healthy cellar, if it is necessary to build it entirely above the surface, and raise the grade accordingly.

It is economy to build compactly, having as much under one roof as circumstances and convenience will admit, and such buildings present a much better and more attractive appearance than those disconnected and scattered here and there about the premises.

The living rooms, such as the kitchen, sitting-room, etc., should be on the southerly side of the house, in the most pleasant and desirable location, so as to freely admit the sunlight. Human beings, like growing plants, require sunshine; and to live and rear a family of children in rooms where the sun seldom or never shines, is criminal, and a gross violation of nature's laws. The sleeping-rooms should be of good size, and as pleasantly located as possible. The farmer's parlor, being so

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seldom occupied by the family, and of very little practical use, if not altogether dispensed with, may be in almost any part of the house not required for a more useful purpose.

The dairy should be on the northerly side, in the coolest place, and so arranged that pure air may be admitted freely when necessary. Steam and vapor from the cook-room should not be allowed to pass to other parts of the house, especially to the dairy.

The house in our cold climate should be made warm, either by sheathing with paper, back plastering, or by a course of cheap brick laid edgewise between the studding. The last is the most effective, and has the advantage of making the house much cooler in summer, and, if properly done, rat and mouse proof.

A house made tight and warm, and heated by stoves, should be properly ventilated, so as to always keep the rooms supplied with pure, fresh air, and prevent cold draughts.

Wall-papers should be discarded, as by chemical analysis much of it is found to contain arsenic in quantities sufficiently large to endanger the health if not the life of the family. It also absorbs impurities from the atmosphere, which it retains for a time, to be again liberated under certain conditions, and create or perpetuate disease. Painted walls of a light color, coated with varnish, are easily kept clean, are more healthy and much better.

Water should be brought into the sink ; and the wood-shed, cellar-stairs, and pantry should be as convenient to the kitchen as possible.

To have a supply of pure water is a matter of vital importance ; and the well, if that is the source of supply, should always be faithfully guarded against the possibility of any impure or poisonous matter gaining access to the water by leaking through the earth or otherwise.

Sink-drains are thought to be the source of much sickness and disease upon many farms, and should be so constructed that the foul, poisonous gases will not flow back into the house, or render the atmosphere impure about the buildings.

Many families living in houses situated in unhealthy loca-

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tions — over wet cellars, or where drainage is defective, or water is allowed to become impregnated with poisonous substances, from sink-drains or other impurities about the buildings, are subject to periodical fevers, or other malignant diseases, frequently resulting in death, which are oftentimes attributed to the visitations of Providence, when the true reason is in or about their own homes, and might have been avoided or removed at little trouble or expense.

Blinds, if judiciously used, are convenient, and perhaps necessary; yet it is better to have none, than to keep them almost constantly closed, as many do, to darken the house and exclude the sun.

A good yard, pleasantly located near the house, should be kept as a play-ground for the children, where they may be allowed to indulge in their innocent amusements when the weather is suitable.

Shade and ornamental trees add greatly to the beauty of the home and the comfort of the family, but should not be planted so near as to shade the buildings, or prevent the sunshine from entering the windows. The surroundings of the farmer's home should be beautified with shrubs and flowers, making it *attractive* as well as convenient.

The size of the barn, and the productive capacity of the farm, should be in proportion. Very seldom is there any waste room in a farmer's barn. Ordinarily, barns should not be less than forty feet in width. The driveway through the center should be twelve feet wide, and this would leave fourteen feet for the bays and the same for the tie-up (if the stock is kept in the main building), which will be found to be none too much for convenience. The better plan is to keep the stock in a wing, constructed especially for that purpose, which should be made warm and comfortable, and so as to admit the sun to shine upon the cattle. Sunshine is equally as necessary for the health of animals as for the family. This is a very important point lost sight of in many modern-constructed and expensive barns, and one which is perhaps not thought of by many farmers.

A stock of cattle can be wintered upon much less food, if kept comfortable and warm, than in a cold barn. If a large

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stock is kept in a tight, warm barn, where hay and other fodder are stored, and the manure is stored in a warm cellar beneath, the vapor and gases, escaping from the cattle and manure, will invariably injure the fodder, and in such cases frost may be seen in cold weather upon the inside of the boarding. If the cellar is open on one side, and the barn has ventilation sufficient to prevent injury, the floor will be cold, and the barn uncomfortable for the cattle. If kept in a wing, it may be made warm, and shut off from the main building or store barn by a slide door, and with proper facilities for feeding may be convenient. The manure may be stored in a cellar beneath the wing, which should be entirely separate from the main cellar. A cellar should extend under the whole barn, and a part may be used for the storage of roots if necessary.

Storage room for carriages, farming-tools, etc., can be had in barns and barn-cellars at a less expense than in out-buildings, and is more convenient, and the buildings present a more compact and better appearance.

The passage way for the cattle into the barn should not be from the cellar by a dark, steep, winding passage, but by an easy inclined plane from the outside, which may be covered by a shed if necessary.

The barn should be supplied with running water, which should be so arranged and protected that it will never freeze.

The poultry-house should be a separate building, near the barn, and if the cellar is open to the south, it affords a warm, sunny place in winter, and access to the ground, which is very essential. Poultry should never be kept in the barn. The building should face the south, with large windows in front, and if practicable the north side should be an embankment.

Every farmer should have a workshop, in the barn or other building, where he may make necessary repairs, and construct many farm implements in cold and stormy weather.

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DOES FARMING PAY?

BY CARDIGAN GRANGE, ALEXANDRIA. — A. F. CHENEY, REPORTER.

Brother S. B. Sleeper opened the discussion by saying the subject assigned us this evening by our worthy lecturer is a broad one, and one that should be studied by us all as farmers; for if it does not pay, we should change to some business that does pay. With some it does pay, while with others it does not pay. It requires much forethought. We should be acquainted with the character of the soil of our farms, also should study to find out the wants of the soil so as to return to it the necessary fertilizers for plant-food. We should also study nature, for that will teach us how and when to put our seed into the ground. Some will sow or plant on just such days of the month, and the moon must be on such a quarter, no matter if the ground is not in condition to receive the seed. I do not believe that we should put seed into the ground until it is warm and dry enough to receive it. Because my neighbor's farm lies warmer and is drier than mine, it is no excuse for me to plant or sow as early as he does, for my land is not ready to receive the seed.

Don't think we should plow so much land, because it cannot be properly cared for. Take a man, for instance, who tries to see how many acres he can plant and sow, and ask him in harvest-time about his crops. He will say that his corn did not do well; he hardly knew what ailed it; it came up well but did not grow very fast; the ears were small and long tips; his potatoes were not hardly worth digging; was most discouraged farming; it don't pay. No wonder it don't pay with him. We should cultivate only as much as we can properly care for and manure well. Don't think our farms are in as high state of cultivation as they were twenty or thirty years ago. We must buy more commercial fertilizers or be more saving of our barn-yard manure. Dig muck, gather leaves, etc., and when we use all the means in our power, we can make farming pay, even in this cold northern climate. We are not apt to give our wives credit enough if we are successful; think as much responsibility rests on the wife as the husband, for if the wife is not economical they cannot succeed on a farm and make it pay.

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When he first began for himself, kept young stock, especially steers; raised them up and had a pair of well-trained oxen to sell every year, and a younger pair to take their place without buying; found this paid. Think we are too far from market to make dairying pay so much as young stock. We should take account of stock as in other trades; think if we reckoned six per cent interest on all money invested in farm and stock, it does not pay, but there are exceptions to all rules.

Brother J. F. Vose believes that farming does pay, but it is necessary to work hard and have much forethought, but thinks we don't work as many hours on an average in a year as the mechanic. God has given the land to till. God has given us strength and reason. God has given us seed-time and harvest. Some one has got to feed the multitude, why not us? We enjoy fresh, pure air; we enjoy life to the utmost; and we are in reality those upon whom the welfare of the nation rests.

When we go to the stores and do not have the money to pay for articles we need and must have, the traders are not afraid to trust us, for they know that the true farmer always pays his bills in due season.

We enjoy the fruits and vegetables in their season, and they are better and more wholesome than you can get in the city. We lay up money, or, what is better, good health and morals.

Sister Sanborn believes that farming pays; is something of a farmer; has her flower-yard to cultivate. Thinks that with judicious care dairying can be made to pay. Must be more careful in making butter, and only make a prime article. Poultry pays if only cared for as it should be. Believes in saving the small things, and that will pave the way for greater success. If the farmers would only spend more time and thought in laying plans for their work, they would be more successful.

Brother O. J. Clough believes that, with most of the farmers, farming pays. It pays better than any other business he ever was engaged in.

A. F. Cheney believes in farming; once wanted to get into a store, but did not like to spend a year working for his board, as he had the farmer's trade partly learned; was glad now that he stayed on the farm. It is a life of independence. No class of

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people are so independent as the farmer. You can have a play-day occasionally, and your crops and stock keep on growing. You don't have to lose a day's pay besides horse hire. Thinks we do not adapt ourselves to the times enough. We are too apt to follow the old ways that our fathers did. With the improved machinery we can do more and better work.

We should endeavor to keep more and better stock; should try to see how much we could improve cattle and sheep. We are apt to slight little things. We should be astonished were we to keep account of all we raise, and if we should reckon what it would cost to buy the vegetables that we raise in our gardens, together with the increased worth, for all will admit they are better than can be found in the city markets.

We are to increase the fertility of our farms. When we make two blades of grass grow where only one grew, it pays. I think the majority of farmers in town are making money. A lazy, shiftless man cannot make farming pay, but an industrious, energetic man will make any business pay. The farmer is more healthy and enjoys life better than any other class of people. They study nature more, and through nature become intimately acquainted with nature's God.

At the close of the discussion a vote of the grange was taken on the question, Does farming pay? and it was decided in the affirmative by a large majority.

HOW SHALL WE MAKE FARMING MORE ATTRACTIVE TO OUR YOUNG MEN?

BY UNCANOONUC GRANGE, GOFFSTOWN. — A. M. DAVIS, REPORTER.

The question presents itself to the farmers of our country in such a forcible manner as to impress us frequently with a sense of its vital importance to the interests of agriculture. And it becomes a question of peculiar interest to those who have sons on the verge of manhood, who are undecided about what occupation, among so many trades and professions, to choose as the one best suited to their talents, and in which they have the firmest hopes of success, if faithfully pursued.

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The fact that our agricultural interests underlie the whole superstructure of our national greatness, and that, through the channels of a commerce made immensely greater by reason of the almost inexhaustible productiveness of our agricultural resources, we are exerting an influence upon civilization which we may well be proud of, and which secures to us the respect of other nations, should cause us to respect the calling of agriculture, and to promote its interests by constantly endeavoring to influence our young men, who are adapted by natural qualifications to be tillers of the soil, to choose that occupation in preference to all others in which to gain a livelihood. And we must not lose sight of the fact that the sons of our farmers are by nature as intelligent and acute, and by education as susceptible of being influenced by reason and common sense, as the sons of any other class in the community. Hence their ideas of the occupation of farming should be early formed, and the fact of its eminent respectability should often be brought to their notice, for the purpose of counteracting the false notion which the young are so apt to entertain when they are left to draw their conclusions from a superficial comparison of the outward surroundings exhibited by those engaged in other occupations, as the personal appearance produced by dress; the comforts and luxuries as shown in the style of living; the adornment of homes made beautiful to the eye by architectural designs; the hours of leisure for study or amusement and recreation, — all of which seem tempting to the eyes of youth.

Therefore, while the farmer teaches his sons not to despise the homely garb so well suited to many parts of his occupation, he should endeavor to clothe them with suitable garments, made in the prevailing style as far as possible, so that they may not feel that to be a farmer is to be inferior to other classes of society, by reason of any necessity for an inequality in personal appearance, and impress them with the fact that the value of a man's clothes has very little to do with the real worth of the man that wears them, and that some of the finest ornaments of society, and the most respected citizens of our acquaintance, are not such by reason of any outward adornment, but by their eminent fitness for the positions they occupy, and their earnest endeavors to fill their positions with fidelity and honesty.

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Again, it has been charged that some farmers, in addition to poorly clothing their families, have been exceedingly economical and frugal in providing for their tables. Happily, there seems to be less of this class than formerly. Now if there is any class in our land more worthy to be well fed than another, it certainly is the farmers, for it is they who have the forces of nature at their command, and are instructed to sow in the morning, and at evening hold not their hand; and also that "he that will not plow by reason of the cold, shall beg in harvest and have nothing;" and the husbandman commits the seed to the ground, with the assurance that, "while the earth remaineth, seed-time and harvest, and cold and heat, and summer and winter, and day and night, shall not cease."

Farmers very naturally wish to turn their crops as far as possible into money, and are usually led to sell what will bring the largest price; therefore they dispose of the best potatoes and keep the poorest for home use, they sell the best apples and use the poorest, and so on through the list of farm and garden products, and when the time comes to market the poultry they usually sell all the best and reserve the old hen for a Thanksgiving dinner.

The appetites of young people are usually keen, and they enjoy a Thanksgiving turkey with the luscious plum-pudding and pies, or the savory goose with the usual concomitants of a Christmas feast, and these good times should not be omitted in the economy of our household affairs, neither should they be the only opportunities for social gatherings. The young should be allowed to invite their friends and mates to their homes, and be assisted in entertaining them, where they will be under the eye of their parents, and in that way they will be more likely to choose such mates as would be more proper associates for them, than if they were driven away from home influences to choose their companions from those who attend public places of amusement. Home should ever be a pleasant place, hallowed by the sunshine of life and its comforts; and the firesides in our farmers' homes upon winter evenings should be enlivened by the outburst of childish glee, and occasionally an hour passed in the enjoyment of some of those harmless games and amusements

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which delight both old and young without vitiating the moral nature of either, or the time should be spent in profitable reading, for which books and papers should be provided. This will cause the heart to cling to the old associations which have been so pleasant. A happy home has done much to influence the young man to remain on the old farm, and smooth the pathway of his aged parents in their declining years; while, on the other hand, a home that has been cheerless and unpleasant, made so perhaps by the stern discipline of too exacting parents, who, in their endeavors to be free from the charge of "sparing the rod and spoiling the child," have discouraged the young from the love of home, because there was little that was lovely about it, and led them to free themselves from its irksome restraints when a favorable opportunity was presented, leaving the aged parents to plod on the closing years of life weary and alone. This prospect has often caused them to abandon the old homestead, because they were unable to manage it properly in their old age. This is one cause of so many abandoned farms.

The farmer who is wide-awake to his own interests and the interests of his family, will, in addition to making his home happy by being social and cheerful, endeavor to add to the comfort and enjoyment of his household by the adoption of such conveniences and facilities in the arrangements of his farm buildings as will render them the most convenient possible, and reduce the labor of conducting the affairs of the house and farm to the most economical basis. We sometimes observe instances where the younger portion of the family are mostly marriageable daughters, and that the head of the family is impressed with the urgent necessity of remodeling or rebuilding the house, keeping in mind the fact that there must be a handsome parlor well-furnished, and things in general made as attractive as possible, for the purpose of disposing of the personal property in question to the best advantage. Would it not be as good policy to fit up the buildings as a hint to the young man that there is room for him, and that it would be entirely agreeable if he would settle down at home?

It is too often the case that the mother is averse to the prospect of another and younger woman coming in to usurp her

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place as mistress of the household, and the son finds it difficult to secure the partner of his choice under such circumstances, and he is led to forsake the old place, and, for want of funds to secure a farm for himself, is obliged to swell the throng who compete with each other for a bare living in our over-crowded cities.

Again, it is often the case that our farmers' sons have a thirst for knowledge, a desire for the study of books, and, in contrasting their privileges and opportunities for study with those of young men in other employments, they gain the impression that a tiller of the soil has little leisure for reading or study; and it is a too prevalent idea that it requires no education to be a farmer, and that farming furnishes no opportunities for the use of book-knowledge. These are errors which should be speedily removed from the minds of our youth. The times are already upon us, when he who would be a successful farmer in New England must be an educated farmer. And what field for education presents the need of such a diversity of knowledge? In the broad range of the sciences, we can scarce name one, which, in one way or another, may not be of use to him who would grasp the forces of nature concealed in the soil, and direct their action, while they evolve from the dust of the earth such marvelous transformations and combinations of matter as to produce such wonderful results. The farmer is met upon the threshold of his observations by some of the most abtruse and interesting questions of philosophy. In the study of the different varieties of soil which he cultivates, he will have ample opportunities to apply an extensive knowledge of chemistry, as his investigations lead to a discussion of the nature, composition, and properties of material substances; also in animal life, with which he is surrounded, there is a deeply interesting field for the acquirement and exercise of useful knowledge, and in the contemplation of which the mind is involuntarily led to admiration and wonder at the sublime wisdom displayed in the marvelous construction, the beauty of form, and endless variety of species exhibited in the animal kingdom. In ornithology and entomology there are wide opportunities for research, presenting much to absorb the attention of the curious, and about which there is yet

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much need of accurate information. Many other sciences could be named, which, if carefully studied by the farmer, would afford lessons of much interest and usefulness. And farmers who have sons that are to become the agriculturists of the future, should afford them every facility for becoming intelligent and educated farmers, and those who can should avail themselves of the valuable advantages to be obtained at our agricultural college. Would they not confer a lasting benefit upon the farming interests of New Hampshire, if every grange or farmers' club in the State would offer a prize of one hundred dollars to the first graduate of our agricultural college residing within their jurisdiction and adopting farming as his occupation?

Again, parents should place in the hands of their children useful and entertaining books and magazines, as far as they are able, to cultivate a taste for study, which will inevitably place them in a position to receive the most advanced ideas relating to their calling. Some one has said, "There is no class so unintelligent as the farmers." Let it not long be so; our position is far above that of farm-laborers in other lands, where the opinion is held by some "that the diffusion of universal education among them would spoil them." They are operated as machines which it costs a given amount for running expenses, while the American farmer is lord of his lands, and exalts his occupation and himself by honest industry and the intelligent direction of the means at his command so as to secure successful results.

Again, the intelligent farmer will systematize his work so as to have a time for everything, and thus have everything done in its proper season. Then there will be no discouraging lagging of work; boys can be made to take a pride in having their work ahead of their neighbors', and thus they will be prepared, if the opportunity should present itself, to spend a day on a pleasure excursion or a visit to their friends.

Most boys have a fondness for young stock, and this natural inclination should be encouraged by allowing them to have for their own some young animal, such as a lamb, calf, or colt, and they should be taught how to rear it in the most profitable manner, how to dispose of it to the best advantage, and how to take care of the proceeds and use them wisely. They should be

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allowed to make small trades, and be accustomed to know the market values of the different kinds of stock and productions of the farm by practical observation. They should be allowed a piece of land to experiment upon and to plant with any crop they desire to cultivate, giving them the benefit of your judgment in the meantime, and allowing them the proceeds of the sale of their crops. The land should not be a tough, hard, rocky piece, that has been neglected for years because of its sterility, as that would make farming very unattractive to them; but it should possess qualities that would encourage them by the abundance of its yield. Make the boys to feel that you are interested in their success and future welfare, and they will give a respectful attention to your advice and counsel.

One other thought which has an important bearing upon the attractiveness of farming to our young men, is the influence which woman exerts upon his destiny. It is not unnatural to infer that the majority of our young men who are intending to become farmers, have a laudable ambition, in addition to having "A little farm well tilled," to have "A little wife well willed." Therefore it is the duty of the mother to impress upon her daughter the fact, that to be a farmer's wife is as honorable, if not more so, than to sustain that sacred relation to one not a farmer. She need not be the less educated or the less refined because she is to become a farmer's wife and helpmeet. It is much better for farmers' daughters to remain at home if needed, or, if they wish to seek employment elsewhere, it is more honorable and more beneficial to them to work in a farmer's home than a city home or manufactory, if we consider their health and happiness in their future relations of life. We sometimes observe that when a young lady goes to the city to seek employment, a certain young man, of whom it was supposed that he would be a farmer, suddenly takes a dislike to farming and goes off to the city also, but the instances are rare where either are the better for doing so.

Therefore, young ladies, stick to the farm, and your eye shall sparkle with the joy of life, and the bloom of health and vigor adorn you with their loveliest charms, and there shall be one to cast his lot with yours, who shall stand by you through the storm

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and sunshine of life, and whose hand, though it be hardened by contact with the plow and spade, is strong to protect and care for you, and is guided by the impulses of as warm a heart and true devotion as is found among human possibilities; and thus united in heart and purpose, you may exalt your calling, dignify your position, and, by a virtuous life coupled with enterprise and guided by intelligence, you may hope to win the reward of a successful life.

NEW HAMPSHIRE FARMING.

BY STARK GRANGE, DUNBARTON. — W. H. STINSON, REPORTER.

There is no subject of greater importance to the people of New Hampshire to discuss and ponder than that pertaining to our agricultural prospects and resources; whether or not our farmers should longer be encouraged to better resolves and better results, or, through lack of interest, settle back into a state of indifference and lukewarmness.

When we consider how our State has been drained of her young men, how farm after farm has been given up and allowed to go back to its former condition, and when example after example, if you please, of slipshod and shiftless farming is daily presented to our view, it is certainly time that we looked more fully into this question of New Hampshire farming, and see whether or not a remedy can be found to stem the tide and awaken an interest of sufficient magnitude to counteract this state of affairs.

For one, we believe, still and forever, in hard, rocky, sterile old New Hampshire; and to every young man who is hesitating as to whether or not he had better locate in some more inviting spot, as he terms it, we would say simply,— "*Dont!*" And why, you ask. Well, there is room for you here, and to the earnest, enterprising young man the future is a good one. I admit it does not have that brilliancy and glitter that appeal to you as you are invited to come West, or locate in our cities and larger villages where all is represented as sunshine and happiness. Be not deceived. If you are striving to become a suc-

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cessful farmer, it can be accomplished only by work, work, work; not all hard manual labor of the arm and muscle, but labor with the mind, brain-work. Profit by your experiences and by the experiences of others.

Two young men start out in life with equal prospects, and are on equal footing, and each has a farm of equal value. The one is laborious, active, wide-awake, and stirring; seldom if ever is found loafing at the village store or office, but who, on having business at either place, attends to his business and returns to his home where he is always able to find something to do; when matters of business present themselves, and affairs in which every live man takes an interest call him from home, and to gatherings of various natures, — as the grange meetings, the farmers' club, and occasionally at political gatherings, for all of these are educators from which the live farmer returns with new thoughts and new ideas, — he strictly attends to his own business, — and what is the result? Why, he is improving his farm year after year; his farm is his bank, and for each withdrawal he makes liberal returns, consequently his farm grows better and better; his barns are filled with better hay and more of it; his stock of cattle has been improved in breed and in care; his house and surroundings are neat, in good repair; his home pleasant, cheerful, and inviting; his children are being liberally educated; the table is provided with the current papers and well-selected periodicals, around which the family gather during the long winter evenings each intent on learning something he or she did not know before; the boys and girls grow up active, intelligent, healthy, and strong, with habits of thrift and enterprise firmly ingrafted in their minds. This is a home in which we delight to linger, and reluctantly take our hat and depart, feeling refreshed and encouraged. The father has a place for everything and everything in its place, and the different departments of labor are promptly attended to in their respective season and there is no conflict one with another. The boy's calves grow to be the boy's oxen, and the girl's lamb, as it reaches more mature years, remains her sacred property; and through the careful management — both indoors and out — the bank account is allowed to be gradually increased year after year until when it is needed to

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assist in starting in life Charles, John, or Henry, it is found to have increased so rapidly that the amount is really surprising.

This, you say, is the "sunny side of farming." Yes, it is; and we can all have a sunny side, — some brighter than others, to be sure, — if we but will, for to every cloud there is a silver lining.

The other young man soon realizes that work and himself had a serious "falling-out" in his younger days, and in spite of precept and example the trouble has never wholly healed over. He finds everything against him — the weather, the seed-time, and harvest; he seems to be always at leisure, and liberally patronizes all entertainments and horse-trots; his farm is rapidly running out, and the wind whistles through his partially-filled barn as in November through a straw hat; and as he goes to the store for his flour, eggs, meal, etc., complains that the farmer's life is a hard one, — everything is so low in the market that it does not pay to raise wheat, corn, or potatoes; the season is either too early or too late, "very unfavorable at any rate;" and it is "flying in the face of Providence" to tempt the beetles by planting potatoes. But what is done when pay-day comes, as come it will? Why, how easy; give a claim on the farm. The children grow up shiftless, and seek company where they may; the loose habits of the father, from which the kind wife and mother has endeavored to keep aloof, at last creep into the household affairs, and late dinners and family quarrels result, and the head of the family finally concludes that New Hampshire farming is about played out and the glorious West is the place where you make money easily and with little labor.

These two illustrations are from life, and undoubtedly have an application in nearly every town in the State. And to this latter class are we indebted for the decline of farming here and the abandoning of our farms. We remarked to an acquaintance of ours a few days since, "How is it that you are making a success of your calling, and yearly making noticeable additions to your stock and improving the condition of your farm, while your neighbor seems to be gradually going the other way, and whose surroundings are every way superior to yours?" He replied, "I will tell you, and in my answer lies the secret of successful farm-

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ing. *I work.* Did my neighbor work as hard as I do, you would see different results." In that answer we have the secret of success, whether in agriculture or whatever industry you may name. Farming is not all sunshine, but a mixture, and is, in fact, what we make it.

Let the farmers of New Hampshire realize this one fact, that if the merchants, lawyers, or doctors were as heedless in their professions as many of their class, they would accomplish as little; those who make a success of life are those who labor early and late with a persistency which knows no such word as "fail." The continual knocking is what finally gains you an entrance.

As we look over our State, we find many who have met with marked success, who have worked their way from poor boys up to men of means, respect, and honor.

The future is full of encouragement to us; for we believe a better day is dawning, and with the many improvements in all departments of farm industry and farm machinery now offered us, and with the many proofs given us by large yields in the various field crops, we are convinced that our soil is productive, and that the farmer of industry will ever be duly rewarded.

FAIRS AS NOW CONDUCTED NOT BENEFICIAL.

BY SPAFFORD GRANGE, CHESTERFIELD. — H. B. MORGAN, REPORTER.

Resolved, That agricultural fairs, as now conducted, are of no appreciable benefit to the average farmer.

The discussion was opened with the proposition that fairs were good in their original conception and design, but they have degenerated till they have become worthless. The elements of value to the farmer have been dropped to a very great extent. The speaker instanced plowing-matches and contests with teams, and said: Horse-trots have come in to take their place, but they do not meet the wants of the farmer. They rather convert the fair into a place for horse-jockeys and sporting men. He then spoke of injustice of awards as being a matter with which he was personally cognizant, and stated that it is the man rather than the product that takes the premium. To illustrate, two

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pairs of oxen were mentioned. One pair the committee acknowledged to be superior according to their standard, but said that it would not do to give them the premium. By means of such things as these, honest men are getting either discouraged or disgusted.

Premiums are mostly given for thorough-bred stock, and address themselves only to a small class of farmers, and would only be mischievous could they induce the masses of farmers to raise only thorough-breds. For in the hands of many farmers they do not succeed, while often the grades of the various breeds succeed admirably; therefore premiums should be offered to draw out and encourage the raising of this kind of stock, and it will open a productive field to a greater number of people.

There used to be instructive speaking on agricultural subjects. This has pretty much gone out of practice, and taking addresses are procured to take their place because of the crowd they will draw. These have to be paid for at high prices. The speaker recalled an instance, when Henry Ward Beecher was employed and paid the sum of two hundred and fifty dollars. These things are of doubtful expediency, even in a financial point of view. In this phase of the fair the stimulus to agriculture is swallowed up in the pageantry and show, and results in an increased desire for show and excitement.

In reply it was urged, that, however bad the management, an institution whose conception was for the benefit of a class, that addresses itself to a class and appeals to their sympathies and interests, will inevitably benefit those in whose interests it was created. It will benefit in this way: Men working upon the same problems will compare methods and results, will measure the progress one with another, and thus acquire a knowledge and skill in their avocations hardly attainable otherwise, or would require a long period of time for their consummation.

Another speaker said fairs should not be given over or set at naught because some sensitive people get hurt, or because of instances of injustice. In the main, the awards are reasonably just. Much of the criticism comes from those not thoroughly informed. And criticism has its uses; it may open the way to needed reforms, but does not prove the worthlessness of the

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thing criticised. Fairs afford benefits in different ways. The more exact and practical knowledge acquired is but one of the results. They afford opportunities for the exchange of stock, and exceptionally good opportunities for exchange, selection, and mating of stock when the animals from different sections are brought side by side, and their various points of likeness, difference, or merit may be compared. The benefits do not all come at first hand, but the light and knowledge gained by those who participate is radiated through the whole circle of their influence, so that those who do not feel an interest, and who do not attend, are the beneficiaries of those who do. For this reason, therefore, importers and breeders of fine stock should be encouraged. They raise the general standard of their neighbors' stock, and thus make grades worth the keeping.

The agricultural papers are a perennial source of benefit, and they draw copiously from this fountain. The interests of the American producer have suffered abroad by not becoming known. The dealers of foreign brands, notably in England, have put our produce upon the market as their own, thus not allowing our products to compete in the open market with their own. An instance of an institution of this kind doing a noble work is that of the Dairyman's Association, which has ferreted out frauds of this kind and enabled American products to stand in the market with their own appropriate brands. And doubtless considerable of the advance in prices of last year was due to the work of the Dairyman's Association; these advances on three leading articles being as follows: Butter and cheese advanced forty-three per cent, and meat thirty-two per cent.

Rejoinder: The market will not yield to the pressure of associations, but rather is governed by the laws of supply and demand. Beside the *absence* of good, substantial work which should characterize such an institution as a fair, there are positive evils all are familiar with who attend the fairs. For instance, the catch-penny shows, obscene songs, and other things akin to gambling that constitute a very bad school for the young.

Apart from this, the premiums offered are not calculated to stimulate thoroughness in farming. The specimens shown are not necessarily specimens at all, as any slovenly farmer may

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chance to find growing in his field a few good ears of corn or some nice vegetables. No premiums within the speaker's knowledge are offered for the best acre of corn or potatoes, or best crop of hay.

Reply: Of course the management is not perfect, neither can it be expected to be better than the masses of the people demand. An instance was mentioned where premiums were given for the best acre of grain, crop of hay, etc.

A short article was read to the intent that people who go to fairs see pretty much what they want to see, and those who stop to while away their time with shows and songs, fail to get the best part of the fair.

A vote being taken on the merits of the question, it was decided in favor of the affirmative.

FIELD CROPS.

BY SUTTON GRANGE. — CHARLES A. FOWLER, REPORTER.

Sylvester S. Felch opened the discussion. I believe we should make a specialty of raising those field crops which produce the most feeding value, and, at the same time, leave the soil in the best condition for grass. Some soils contain elements perhaps better adapted to other crops, but I am inclined to think that corn, with its fodder, is the leading crop in this respect, on most of our farms.

I believe in rotation of crops; also that every practical farmer ought to raise his own potatoes. We should not raise more than one crop of potatoes on the same field before sowing it down to grass, as they extract from the soil the very best elements required for hay. Potatoes cannot be considered a paying crop when less than three hundred bushels to the acre are produced. This quantity contains thirty-two pounds of phosphoric acid, one hundred and two pounds of potash, and fifty-eight pounds of nitrogen. About the same quantities are removed by three tons of good hay. Also eleven pounds of sulphuric acid, or as much as is contained in nine tons of hay, while the feeding value of seventy-three pounds of corn, or one

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hundred pounds of hay, is equal to three hundred and nineteen pounds of potatoes.

The precise origin of the potato is unknown. It grows wild in Valparaiso, also in Peru, and other parts of South America. Travelers tell us they flourish in the Chilian mountains, where sometimes rain does not fall for six months at a time, as well as in the humid forests of the archipelago. They were introduced into England by Sir Walter Raleigh about the beginning of the seventeenth century. They were first cultivated in the gardens of the nobility, as curious exotics, but soon came into general use.

My method of cultivating has been to spread a liberal quantity of green stable manure on the field I wish to plant, breaking up and planting as early in May as the land is dry enough to work. I use Lufkin's swivel-plow, which inverts the sod and leaves the ground in a condition which requires but little harrowing. Plow about seven inches, or just deep enough to cultivate above the sod. I mark my rows three and one-half feet apart, hills three feet apart, putting a handful of wood-ashes in the hill. I cut a medium-sized potato in four pieces, or two well-developed eyes on a piece. Drop two pieces in a hill, one each side the ashes, being careful not to have them come directly in contact. Cover from one to two inches deep. As soon as the plants break the ground, so that we can follow the rows, go through with the cultivator, and the more the ground is stirred the better until they commence budding for the blossom. Care should be taken not to hill them up too high. If you bury your potatoes too deep while hoeing, like the man who buried his talents, you will find nothing but small potatoes when you come to dig. If weeds start after the plants have blossomed, pull them or cut with a sickle, and remove from the field. Cultivating at this time is likely to start a new set of tubers, to the injury of those already growing.

The first appearance of the Colorado beetle in New Hampshire was in 1875 or 1876, some of our scientific and experimental farmers having them sent here by mail, as curiosities. But like the man who drew the elephant in a lottery, —

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"As soon as they saw the critter's head,
And learned the way the fellow was fed,
Their curiosity was o'er;
They wanted to see him no more."

They come to us now by their own conveyances, in countless numbers, like the plagues of Egypt and the grasshoppers of Kansas; but, unlike these plagues, they have come to stay. Although they have been with us but three or four years, it is of no use to flatter ourselves that they are only visitors. Wherever you find the Colorado beetle, he is perfectly at home, and some of his family always hang around the old homestead. As his name indicates, he comes to us from the far West, and brings with him the habits and usages of the frontier settler. He believes in squatter sovereignty. He has given us notice of his intention to become a *bona-fide* settler, by appropriating the land. His statement is already on file that he intends to make it his permanent home, and that the appropriation and settlement are for his own exclusive benefit. It is useless to plant potatoes unless you have combativeness and perseverance enough to make a square fight with him and give no quarter. To protect my potatoes from the beetle, I use Paris-green mixed with plaster-paris, — fifty pounds of plaster to one pound of Paris-green. When the larvæ begin to hatch, dust the plants thoroughly, while the tops are wet with dew, or after a shower. The moisture helps to retain the mixture on the plants. When the plaster is washed from the plants by showers, it is not a total loss, but helps largely to promote the growth of the crop. I use a tin duster with very fine tin screen, and stationary handle, one twist of the hand being sufficient when the plants are small. Repeat the dose as often as the grubs are found at work. Twice over the field usually does the work, but sometimes have to doctor scattering hills afterwards. The time of digging is governed by circumstances. Once on a time, as the story goes, a retired merchant thought to raise his own vegetables. He could plant potatoes as well as anybody. After getting them well under, he went over across the way to his neighbor, an old Patron, and says, "Well, neighbor, I'm going to raise my own potatoes this year. Now about what time had I ought to dig

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them?" — "I don't know," says the farmer; "when did you plant them?" — "Planted them to-day; got some first-rate seed; put four in a hill." — "Well, squire," says the old veteran, straightening up, "I should dig them *to-day*. The sooner you dig those potatoes the more good ones you will find." I dig my early potatoes as I want them to use. Letting them set around in the air and sunlight may increase their strength, but certainly does not improve their flavor. As a rule, potatoes should be harvested just as soon as they are ripe enough to handle without breaking their skins. When their skins are broken they not only look rough and unsightly, but we may be sure they have not quite attained their perfection. The tops should not be burned or removed from the field, but should be plowed under. On a good crop of potatoes, when the tops have attained their growth, two tons per acre might be a fair estimate of their weight. The tops contain the same elements as the tubers, in nearly the same proportions, according to weight. Consequently, removing them would make so much the greater drain upon the soil. Nine tons of tubers contain: —

Water.	Ash.	Nitrogen.	Potash.	Lime.	Phosphoric Acid.
13,500	57.6	57.6	102.6	3.6	28.8

Eleven tons of tops contain: —

Water.	Ash.	Nitrogen.	Potash.	Lime.	Phosphoric Acid.
16,300	77.2	77.2	119.8	29.2	34.2

The above figures are estimated from a table published in the "American Agriculturist," and agree very nearly with Prof. S. W. Johnson's table in his book "How Crops Grow." We can readily comprehend something of what the crop has extracted from the soil without the figures, as, when we get three hundred bushels per acre, the tubers alone weigh nine tons. When potatoes bring thirty cents a bushel, it is sixteen dollars per ton. Now, although their relative feeding value is small when compared with other crops, and they seem to be almost worthless when given to grass-fed stock, I consider them a very valuable feed in connection with hay. I feed the most of my surplus potatoes to sheep. Think they do enough better to pay for the potatoes, and in this way return the borrowed elements to the

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field in the best possible condition to be again taken up by corn and grass in their turn.

Josiah P. Nelson. — I plow in the fall and harrow in the manure in the spring. Fair crop. Have raised four hundred bushels to the acre on pasture-land.

Thomas Roby. — Plow the manure in in the spring; ashes in the hill; get two hundred bushels marketable potatoes to the acre.

Jacob B. Nelson — Harrow in the manure; phosphate in the hill; hoe twice; good crop.

Henry V. Little. — Think it best to harrow in the manure. When I planted in hills three feet by two and a half feet, I once raised two hundred and four bushels of sorted potatoes on ninety rods of ground. Coarse manure harrowed in. Now plant in drills, as it is more convenient, using double mold-board plow. Loam used as an absorbent about the sink-spout, is an excellent fertilizer.

Francis Blaisdell. — Generally raise about two hundred bushels to the acre. A few years ago, plowed one and three-fourths acres of pasture-land, and before I seeded it down took from it about sixteen hundred bushels, at a profit of thirty-five cents per bushel.

Charles S. Watson. — I plow in the manure in the fall. Plant large potatoes, cut about the time of planting, — four pieces to a potato, two pieces in a hill. Hoe twice; large hill. Average two hundred bushels per acre. When planted without manure, plaster has sometimes doubled the crop.

Charles A. Fowler. — From more than twenty years' practice, I am convinced that potatoes too small for market — the size of hens' eggs — are quite as good for planting as larger ones. Usually break up, in spring or fall, land that is bound out, harrow thoroughly, and apply ashes and plaster in the hill; no other manure; get a fair crop of good potatoes.

Erastus Wadleigh. — New land or pasture-land is well adapted to potatoes. Early-planted potatoes are sometimes best, on account of rust. If they don't rust, late-planted potatoes are often best. I know of one experiment where plaster produced twice as many potatoes as ashes. On account of the uncertainty

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of the market, it is perhaps not advisable for farmers to raise a superabundance of potatoes.

John Pressey. — I have not cultivated potatoes very extensively. The crop sometimes pays and sometimes it does not. Usually break in the fall and harrow in manure in the spring. Use a barrel of phosphate mixed with plaster, hen-manure, loam, etc., to the acre, in the hill. In this way, try to get the crop ahead of the rust. Raise the kind that sells best.

CORN.

John M. Pressey. — I used to buy corn, but I think we should raise our own. Three things are essential to success; proper land, the right kind of seed, and clean culture. Weeds should not be allowed to grow and go to seed. The only way to prevent it, is to hoe in August. Use the cultivator till the last time hoeing. For neat stock, corn should be fed with the cob. Cobs are conducive to the health of cattle. Stockbridge fertilizer is fifteen per cent better than hog-manure in the hill.

Thomas Roby. — We should raise our own corn. Stockbridge for corn, and Bradley's XL, have paid well. Hill and Drill has not.

Selim N. Welch. — The most successful corn-grower I ever knew saved all slops from the house, and put them in the hog-pen, with horse-manure. Cultivated both ways — four stalks to a hill. Fodder paid for raising the crop.

George S. French. — We attempt to cultivate too much land. We must fertilize liberally, and cultivate thoroughly. Corn-raising has been too much neglected. I believe we can raise corn cheaper than we can buy it. On heavy, late land, harrow in manure, and put some in the hill. On other land, plow in the manure. Raised the past season fifty bushels sound corn on three-fourths of an acre.

Joseph P. Nelson. — Muck, manufactured by the long-snouted machine into a fertilizer, for corn, is better than anything we can buy.

John Pressey. — I have bought considerable corn, but have concluded to raise it or go without. If farmers can't raise corn, they had better quit the business. We must study how to better

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enrich our land. Men who raise most corn use chemicals in various combinations. I plow in fall or spring, as most convenient, and harrow in the manure. Compost in hill. Use much muck as an absorbent.

Erastus Wadleigh. — The kind of soil and its preparation, and a judicious selection of seed, have much to do in determining the crop. Seed from a more northern latitude, or from colder land, is best. Hoeing is important. The third time hoeing is better than either of the others. We should raise corn if our land is adapted to it. On dry or light land, fine manure should be used.

Francis Blaisdell. — In the fall, I plow in what manure I have, the rest in the spring. Plow shallow, cultivate thoroughly. Soil not first-rate for corn, but average over one hundred bushels ears to the acre. Compost in hill. I cultivate with reference to grass, as that is the most important crop. All crops should be hoed when dry.

Sylvester S. Felch. — I plow in the manure in the spring. Cultivate both ways, as soon as we can see the corn, and as late as we can get through it. Compost in hill.

Henry V. Little. — I plow in the manure on sod in spring. Hog-manure best in the hill. Next, well-rotted sheep-manure, or compost. If land is not heavily manured, better plant small kind. Corn should not be too thick, as it must have the sun.

Jacob B. Nelson. — I break up in the fall; harrow in manure in the spring. Phosphate and plaster in the hill. Cultivate three times thoroughly. Three feet between rows and two and one-half feet between hills. Last season was not very good for corn, but I raised seventy bushels shelled corn to the acre, all sound.

Charles S. Watson. — I plow in the manure on sod immediately before planting, when the grass has got a good start. Compost in hill. Cultivate thoroughly.

Josiah P. Nelson. — Break up in fall; harrow in the manure in spring. Compost of loam and hen-manure in hill. Hoe as many times as the weeds come up.

Charles A. Fowler. — I generally plow in the manure in spring, where potatoes were grown the year before. Take much pains

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in covering. Mix the seed with soft soap, and use enough plaster so that it can be conveniently dropped. Think it prevents injury from wire-worms and crows, and gives the young plant a vigorous start. Use plaster and Bradley's XL in hill. The fodder, if properly secured, is a large item in the profits of a crop of corn. As soon as the small ears are "glazed" (which is generally about ninety days from planting), I select seed for the next year, and then shock the corn. The fodder, fed in connection with poor hay, or straw, I consider as good as the best hay. Average from forty to sixty bushels per acre.

WHEAT.

Erastus Wadleigh. — Deep, hill soil, neither too wet nor too dry, is best adapted to wheat in this locality. It generally grows best when preceded by Indian corn, or potatoes. If the ground is dry enough, we prefer to plow thoroughly in the fall. In the spring harrow till sufficiently pulverized, and apply a top-dressing of ten or twelve loads of fine manure per acre. Sow as early in the spring as the land will permit, one and one-half bushels per acre, so as not to impede the grass from catching. The grass-seed best suited to our land generally is timothy, clover, and red-top. This should be put on liberally, and should not be buried too deep. The ground should be merely brushed over, or rolled when moist. Several new varieties of wheat have lately been sown. We have tried a bald wheat, called by some the "Lost Nation," that has succeeded well, and is a heavy wheat, but think the flour not so white as some varieties we have had. We have had but little success with winter wheat. In some localities it may do well, but is not adapted to our hill-land.

In sowing wheat, great care should be taken to have it free from foul seed, and that the best quality be sown. We prefer to have it threshed by hand, and then not clean, leaving the deficient wheat. We often soak the wheat in warm water impregnated with salt, till it begins to swell, then roll in plaster, lime, or ashes. Formerly we were troubled with smut; then we rolled in lime. The rust is apt to prevail in late-sown wheat, or on low land. In harvesting we should be careful not to expose

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it to wet weather after being cut; and care should be had not to have the straw mold. The wheat-crop, when above fifteen bushels per acre, may be deemed profitable. We prefer oats, barley, or some other crop, when below this quantity. On light, plain land, buckwheat is sometimes profitable. The flour is often used in various ways.

The best top-dressing that we have used was sheep-manure that had been accumulating in a hovel in the barn, it never having heated. A compost of dried, exposed meadow-muck, leached or unleached ashes, hen-manure, hog-manure, excrescences from all animals, plaster, lime, salt, scrapings from barn-yard, soap-suds from the kitchen, liquid manures, and all decayed vegetables, can all be utilized and made a good fertilizer for the hill in planted crops, or a top-dressing for sown crops.

Most of us farm for the profit of it. Our labor is our capital, and we should make the best of it. We should think and observe more, and make careful estimates of each crop raised. Guess-work is as uncertain in farming as in other employments. I have known farmers to make bad work guessing. They would estimate the crop double what was raised, and the price double its value, and in the end come to grief. The estimate of the quantity and value of crops on a farm, without common sense and good judgment, does not amount to much. Fifteen bushels of wheat may be deemed a fair average crop per acre, and we estimate the expense as follows:—

		Dr.
Plowing per acre	$1.50	
Seed, one and one-half bushels	2.25	
Manure, exclusive of future use	10.00	
Sowing, harrowing, and rolling	1.50	
Harvesting and threshing	3.50	
Interest on land, and taxes	3.00	
Total expense	——	$21.75
		Cr.
Fifteen bushels at $1.50	$22.50	
Straw	1.25	
Total income	——	$23.75
		21.75
Net profit		$2.00

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This does not show a great immediate profit, but we should take into consideration the leaving of the ground in a favorable condition for grass. If we have suitable ground for wheat, we should raise it. We should avoid buying all cereals from abroad as much as possible.

Selim N. Welch. — The profits on wheat, as shown by Brother Wadleigh, are very satisfactory. Judging from the elements of wheat, particularly gluten and starch, I think liquid manures, composted with muck, would be a good fertilizer.

Francis Blaisdell. — I sow the last of May. Land plowed in spring. Soak the seed in water and dry it with plaster. Average, fifteen bushels per acre.

Charles S. Watson. — I use the best of seed, — the shatterings from handling the sheaves. Raise wheat after corn and potatoes. Best after corn where it had been liberally plastered.

John Pressey. — I do not raise much wheat. Land better adapted to other crops. Wheat, being a higher order of vegetation, requires the best of conditions. We should endeavor to inform ourselves as to the best means of its production.

John M. Pressey. — I do not raise wheat, but think that all farmers who have suitable land should raise it.

Thomas Roby. — Wheat is not so exhaustive to the soil as oats, so it is better to seed down with. My land not being good for spring wheat, I have been trying to get a variety of winter wheat adapted to it, but have not yet succeeded.

James S. Bohonan urged the importance of the selection of good seed, and the use of blue vitriol as a preventive of smut.

Henry V. Little. — I used to sow wheat in spring, after corn or potatoes. The last two seasons I have sown part winter wheat. The winter wheat yielded best, and the grass after it was much better. Soak in brine and blue vitriol.

Jacob B. Nelson. — I sow after corn and potatoes, one and one-half bushels to the acre. Soak in brine and dry with lime. Get more than fifteen bushels per acre.

Charles A. Fowler. — I sometimes plow in the fall, sometimes in the spring. Wash in strong brine, and then stir in two ounces blue vitriol (dissolved) to a bushel and let it stand two or three hours. Dry with plaster. Thoroughly harrow and apply a light

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coat of manure. If wheat is cut when the kernel is soft, so that it can be crushed between the thumb and finger, it is thought that it will make more and better flour, while the straw is more valuable than if cut later.

George S. French. — I have not raised much wheat of late. Have raised it on intervale land after corn and potatoes. Sometimes plowed in the fall and harrowed in manure in the spring, and sowed without hoeing at all. Sometimes the crop is good, and sometimes not. If the wheat does not make the whitest of bread, we know what we are eating, and have the satisfaction of having raised it ourselves.

PASTURE IMPROVEMENT.

BY SOUHEGAN GRANGE, AMHERST. — A. MILTON WILKINS, REPORTER.

Brother J. U. Prince, in opening the question, said: We are all dependent upon the grass-crop. We all know the laws of nature, and that if we violate those laws we must suffer. We do violate those laws by removing those substances which enter into the formation of beef and milk, and putting nothing back to supply the drain which we make upon the soil. We put forth all our efforts to make our fields produce more, and do nothing for our pastures. We feed our pastures too close, so that there is nothing to protect the grass-roots in winter.

Now what shall we do to fertilize them? No two are alike, so that what will help one may not do another any good. Lime, plaster, phosphates, and bone-dust are all good. Plaster, at the rate of one and a half or two bushels per acre, gives the best results; that amount is just as good as more. If the pasture is a clay soil, he would plow it if he could so as to new seed. Some recommend salt, for it will kill the bushes and increase the fertility. Would be careful and not overstock, but would let pastures rest so as to new seed.

Brother J. P. Trow said he would plow if he could, to bring up new elements of plant-food and get new grass-roots. If he could not plow, he would let it grow up to wood (for wood grows

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fast); cut it, burn it, and so have a new pasture. If it would not grow wood, he would top-dress with ashes and plaster if a clay soil, or, if other soil, with salt and plaster, one-third salt and two-thirds plaster. If his pasture had partridge-bush, he would sow salt to kill it.

Brother J. H. Upham said there are many ways to improve our pastures if we only set ourselves about it. He had not tried it, but thought that sheep or hogs turned into a pasture would kill the bushes and improve the fertility. Had a good opinion of plaster.

Brother T. M. Harvell said he could not tell much, but would like to ask the best way to kill bayberry-bush. He knew that to let it grow up to wood would do it, but he wanted a quicker way. He thought that if we would harrow our pastures to kill the moss, and then new seed, that we should get better feed.

Brother Prince said that salt would kill bayberry-bush.

Brother William Pratt said that to stock wholly with sheep will depreciate a pasture faster than cows. A good cow will carry off sixty pounds of sulphuric acid per year, and if we are going to put back anything we must put back those elements that have been carried off by the cow, — phosphate and potash. If we let wood grow and then burn, we get potash from the ashes and the result is a good pasture. Ashes would do us more good if we would put them on our pastures instead of our fields. Nitrogen costs more, and is harder to keep, for it leaks out.

Brother A. S. Wilkins thought that the best results were obtained by plowing the poorest land; his had been greatly improved by plowing, sowing with fodder-corn, and then reseeding with red-top and clover. Had got good results from sowing on ashes, plaster, and lime.

Brother B. B. Whiting said he would plow and put on fertilizer of *some kind*, — plaster or Stockbridge, if he had to buy.

Brother S. D. Herrick said there is everything on the farm that is wanted. Would cart from the dry to the wet places, and from the wet to the dry, and top-dress with loam, ashes, and salt, which he thought better than stable manure.

Brother J. G. Haseltine said that he was troubled with gray

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birch, but thought that if they were cut when the sap runs free that they would not sprout badly; that he once heard J. S. Gould say that it would help our pastures to burn them over in the spring just after the snow goes off.

Brother F. W. Holbrook said that he could not get good results from plaster, but thought it would do well on clay soil. It did not pay him to plow; he could soil his stock cheaper.

Brother W. H. Hubbard said that plaster had given him good results on grass-land some years, while other years it had not, but on the whole he favored it.

MANURES AND THEIR APPLICATION TO THE SOIL.

BEAR HILL GRANGE, HENNIKER. — BY JAMES FELLOWS.

This subject is one of great and increasing importance to the farmer; one that has been much discussed throughout the whole country, and particularly in New England, and its thorough comprehension is the key-note to success in obtaining remunerative crops upon our comparatively sterile soil.

The plant cannot grow without proper food, and where that food does not exist, or has been exhausted by long-continued cropping, it must be supplied by the farmer, or he will receive but a poor return for his labor.

In order to supply this want judiciously, and obtain a suitable return for expense and labor, it is necessary that a knowledge of the wants of the plant be possessed, and also a knowledge of what plant-food is wanting in the soil. This may be obtained by a careful analysis of the soil to a certain extent, but, as the experience of our most eminent chemists have shown, not to an absolute certainty. At any rate, there is much disagreement upon this point among them. And were it within the scope of the average farmer to obtain analyses on his farm, it is doubtful if this would be the most judicious course for him to take. Besides, the difficulties in the way of a correct analysis are many, chiefly the expense of obtaining the services of a suitable chemist who could give time and attention to the proper analysis of

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the soil of the numerous farms of New Hampshire. One analysis to a farm would be but a small advance towards the accomplishment of the amount of scientific labor to be performed on each farm, as there are few, if any, farms composed entirely of the same soils originally. Then multifarious changes have taken place in each field, by the great variety of fertilizers and manures that have been applied in the many years it has been cultivated, and the various crops it has borne. Year after year plants have extracted their special food, until a complete change may have taken place in the properties of the soil.

These difficulties, and others that might be mentioned, absolutely prohibit the employment of a first-class chemist (and any other would be worse than none) on even a very small minority of our farms.

And as for our farmers being able to qualify themselves to properly discharge the duties of a chemist, in a manner that would benefit them to any great extent, it is not only improbable, but impossible, only to a very limited extent.

What course, then, shall we recommend to the farmer? In what way shall he obtain the knowledge requisite to enable him to discharge successfully the duties of his calling? He must try to accomplish with means within his reach what he finds so difficult to satisfactorily obtain from soil-analysis.

By consulting any good work on chemistry, we can ascertain many things which will be of great use to us in obtaining a knowledge of the wants of our various crops, — viz., corn, wheat, rye, oats, potatoes, roots, grasses, etc., — and knowing their component parts we will extend our researches far enough to learn how we may obtain and apply them.

Take, for example, the analysis of corn, or wheat, and we shall find that the most available elements of a rich soil enter into the composition of the grain of corn or wheat; viz., magnesia, potash, and phosphoric acid. Now, unless the properties which are so largely drawn from the soil, by the cultivation of these crops, be returned or supplied to the soil, it must by constant cropping soon be exhausted.

This fact needs not argument to sustain it. It is an axiom that stands forth as a warning to the farmers, and points to the

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inevitable conclusion, that, unless he supplies the soil with abundant and proper food, it will in the end fail him in returning remunerative crops for the labor he expends upon it.

Go to our forests; the more luxuriant and heavy the growth, the better. Why has not the soil become impoverished by sustaining the immense growth of wood and timber we find there? The fact must be admitted that we find by an analysis of the ashes of the trees of the forest that they have been sustained, and that their growth has been promoted, by drawing from the soil the same elements that sustain the wheat and corn plant. Then why are the forest lands growing richer year by year, or at least holding their own, while the wheat, the corn, and the potato lands are continually growing poorer? The reason is plain. We are continually removing from the soil of our cultivated lands, in the crops, the very properties that produce them, and unless these elements are returned the soil becomes barren and worthless; while the trees of the forest shed yearly a bountiful coat of manure upon the soil that produces them, in the form of leaves, constituted largely of the very material that the growth of the tree has drawn from the soil. But this is not all; the ground is covered, to a considerable depth, with those leaves, bark, wood, etc. These form what is called carbonaceous matter, and as they decay a mold is produced, and mold, says the chemist, is the half-way house to decay. It remains in this state of partial decomposition, while the forest remains, for want of light and heat. Yet a continual change is going on in this mold, the older portions forming carbonic gas.

Whilst nothing can be annihilated, change, especially of vegetation and animal existence, is constantly taking place, and the change is simply to enable living matter to exist from dead matter. It is resolved into gases, and these pass into the living plant, again assuming a solid form. Mold thus sustains growing vegetation, for it is the remains of previous living vegetation. The greater the amount of the mold, the more can vegetation be sustained. The reverse is equally true.

With these facts before us, it is an easy matter to determine the cause of light crops and barren soils. We must return to the soil what has been taken from it, or its equivalent.

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Now the question arises, — how and what are the best means by which it can be accomplished? Shall chemistry be brought to our aid? Or shall we plod on as our fathers did, entirely in the dark, trusting wholly to the droppings of our domestic animals to renovate our failing lands, and attempt with that alone to cause them to produce remunerating crops?

We are satisfied that the intelligent farmer will not hesitate to call to his aid the light which science will shed upon every inquiring mind, to enable him to accomplish the important work before him. For this renovation must be accomplished, and the soil must be brought to a higher standard of fertility than the average New England farm now possesses where scientific knowledge has not shed its benign influence; or we must bid farewell to profitable farming in New Hampshire.

When the land was new, and the soil contained the elements of plant-food in abundance, enriched by the primeval forests, the careless, unskillful farmer might succeed in supporting his family, in the cheap way of living then practiced, from his farm. But that day has passed; the soil to-day makes but scanty return for labor expended upon it, unless bountifully fed with proper food. But with judicious application of this, we may again see our old farms throw off their sterile look, and be laden with abundant harvests. Now can this supply be furnished wholly from the farm, or shall we call patent fertilizers to our aid? We believe there is little necessity of our resorting to the latter, to any great extent. Not that they are worthless, for most of them, undoubtedly, are of great value, and will aid materially in producing good crops; but a substitute can be manufactured by every intelligent farmer, equal in its effect, and at much less expense. The principal materials of which most of them are composed can be had on every farm, and more than the expense of transportation saved.

Although millions of dollars are now invested in this country and Europe in the preparation of phosphates for agricultural purposes, and their importance is almost universally admitted, so much so that there are few diverse opinions to consider in regard to it, yet it should be remembered that many practical men, manure-manufacturers, and even editors of agricultural

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papers are not infallible, but often hold very erroneous views in regard to the value of phosphates, or, rather, to the source of their value. Some contend that the value is due to the nitrogen the phosphate contains, and hence, when that ingredient is wanting, the phosphate is valueless. Now this essential property in phosphate is obtained from bones; in fact, bones are the chief reliance of a majority of our phosphate-manufacturers. Now, the best of bones contain only from four to five per cent of nitrogen, and weathered bones, from which superphosphates are usually made, contain less than two per cent.

We will suppose a farmer purchases a ton of superphosphate, containing two per cent of this nitrogen, for forty dollars; he thus gets forty pounds of nitrogen. In the process of decomposition, one-third at least of this nitrogen is liable to loss by evaporation and otherwise, so that there remains about twenty-eight pounds for his forty dollars, on the supposition that nitrogen is all he buys. Now nitrogen, in sulphate of ammonia, can be bought for eighteen cents per pound, and in other forms for less. If, therefore, this is all the value there is in a ton of superphosphate, it might have been bought for five dollars, and thirty-five dollars saved to the purchaser. Although many have advanced the idea that nitrogen is the only valuable property in superphosphates, we are not of that opinion, but believe, with many others, that there are other valuable properties in most of them. And when short of animal manure, or we have not time to prepare a substitute, it will pay to use superphosphates, guano, etc., to a limited extent. But we should buy only such as are manufactured by reliable parties, and those according to chemical analysis. Unless we take this precaution, we shall never be safe in purchasing them, for some of them are known to be almost entirely worthless. A correct analysis will alone enable us to purchase with safety. We then know what we are purchasing, and by learning the price of the ingredients of which it is constituted, we are prepared to act understandingly in our purchase. Many of the best manufacturers are pasting a paper on the cask, containing an analysis of its contents.* This is as

* Our State law requires it, and makes the dealer liable to a heavy fine in case of neglect or false marking. The price of nitrogen and potash is too low in the writer's estimates. — Sec.

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it should be. By doing so the manufacturer becomes responsible, or liable, to the purchaser, if the analysis he gives is found to be incorrect.

Now the expensive constituents of most of these patent fertilizers, and the amount in a hundred pounds, are about as follows: —

Two pounds of nitrogen worth about	$0.34
Four pounds soluble phosphoric acid	.50
Ten pounds insoluble phosphoric acid	.45
Eight pounds potash	.32
Seventy-six pounds of sand	.00
	$1.61

A ton, therefore, would cost thirty-two dollars. We would here again remark, that, whatever price is fixed to the nutrient elements, manures should be sold according to analysis, at this price.

But we trust the day is not far distant when the farmers of New Hampshire will be self-reliant, in respect to manures and chemical fertilizers.

In the beginning of this paper we remarked on the difficulty of the farmer's obtaining a correct analysis of the soil on his farm. Therefore we must resort to other means to ascertain what plant-food is wanting. Carefully-conducted experiments will enable us to obtain this information, with almost absolute certainty.

Every farmer should lay off a small piece of land for the purpose of carefully experimenting with a variety of manures and chemical fertilizers. In this way he will soon be able to determine what fertilizers are best suited to his soil, what is the best method of applying them, and what combination of them will produce the best effect. Experiments of this kind, carefully conducted, and the results noted, will be of incalculable benefit to every Patron of Husbandry, and should be neglected by none.

We expect to derive much benefit from our agricultural college upon this point. They may enter more extensively into scientific experiments, conduct them with more precision, and thus be enabled to arrive at more satisfactory conclusions than most farmers will be able to do.

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By resorting to a chemical analysis of barn-yard manure, we shall be able to ascertain what, if anything, is wanting in its composition to supply the demands of growing crops. We shall be surprised to find how nearly its constituents are allied to the constituents of wheat, corn, oats, and, in fact, to nearly all the crops we cultivate on the farm. Consequently, with good barn-yard manure, we shall be able to supply all the plant-food required, to grow successfully the various grains, grasses, and vegetables we cultivate. And had we an abundant supply of it, we could get along very well without phosphates, or other patent fertilizers. But here is where most farmers fail. Therefore the necessity of artificial manures. It will not do to buy stable manures (were they to be had) if they have to be moved only a short distance, as their analysis shows that other substitutes can be had for what it would cost to transport a ton of manure only a few miles. For chemical analysis informs us that one bushel of wood-ashes, ten pounds of common salt, six pounds of bone-dust, two pounds of plaster, and eight pounds of nitrogen contain the same amount of fertilizing properties as a ton of ordinary barn-yard manure, and will not cost over $1.75. We say "ordinary barn-yard manure," for some manure contains twice or even three times as much of the valuable constituents of manures as others, and consequently are twice or three times as valuable. There are some who think manure is manure, no matter from what it is produced. This is not the case. A ton of manure made from clover hay is worth twice as much as a ton made from straw. As a general rule, the better the animal is fed, the richer and better will be the manure.

We find many analyses have been made by eminent chemists to ascertain the value of manure made from the consumption of a ton of different kinds of cattle food. None of these experiments have been conducted with more care or scientific knowledge than those of Dr. J. B. Lawes, one of England's most eminent chemists. He estimates the manure made by the consumption of a ton of food as follows: Oats, $7.40; wheat, $7.08; corn, $6.65; barley, $6.32; clover hay, $9.64; timothy, $6.43; oat straw, $2.90; wheat straw, $2.68; barley straw, $2.25; potatoes, $1.50; mangolds, $1.07; linseed cake, $15.65; etc. Now

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we do not claim, that, in all sections of the country, the manure is actually worth these sums. All that we claim is that these sums indicate the comparative value of the manure. There are many sections of the country where manures are not as valuable as here estimated, but throughout New England, and particularly in New Hampshire, where manure is indispensable to the farmer, we know of no source from which fertilizing matter can be obtained at a cheaper rate.

One important fact is here presented to the farmer which he should not lose sight of; and that is, the value of hay or other fodder should not be estimated alone by the benefit to his stock derived from eating it, but to that should always be added the value of the manure thus obtained. This is an inducement to feed all the hay, stover, and animal food on the farm. Farmers should think twice before they sell a ton of hay. Let them deduct from the price they obtain for it the value of the manure it contains, and the price they get for it will be so insignificant that few will be willing to impoverish their farms by so pernicious a practice. And it points also to an item of profit often overlooked in stall-feeding and fattening cattle on the farm.

The important facts revealed by chemical analysis should not be discarded by any one who obtains his livelihood by the sweat of his face, for by profiting by them he is the one to derive the greatest benefit.

Book-farming is often ridiculed by the ignorant farmer. Such men will add little to the wealth of the country, or the intelligence of its society. They are usually men of physical rather than intellectual strength, and of sturdy muscles, and of great endurance, — men who are content to follow in the same ruts their fathers trod, on whose minds never dawns the light of intellectual and scientific agriculture, who look to the phenomena of the heavens, and particularly to the age of the moon, as indices of cause in the production of crops. The ideas of such farmers are as undefined upon the subject of the causes producing crops as were their fathers', who thought more about the lunar sign in which they planted their potatoes than the soil in which they were to grow. But the ideas of such men are fast becoming obsolete, and those who entertain them are fast pass-

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ing to the long home of their fathers. If farmers will not avail themselves of the benefits derived from science, they alone are to blame; and if the scientific farmer outstrips them, and raises bigger crops and makes more money, they can thank themselves for their obstinacy and folly.

Science informs us that all plants contain certain elements, which they draw from the soil; and unless these elements are returned to the soil, in manures, it soon becomes impoverished, the plant-food exhausted, and crops will not grow. Now most manures are nothing more than a combination of elements, previously derived from the soil, and it is but natural that these elements must be returned in order to keep the soil in a healthy state, and in proper condition to furnish food for man and beast. The principle thus defined embraces the fundamental basis of *art and science* of manuring crops.

Let us illustrate this principle more fully. We will consider the soil as the bank of deposit; the crops taken from it as the successive drafts made upon it; and the manure added as the several deposits upon which its solvency depends. Or, to speak more philosophically, we might consider the crops as the effect, and the manure in the soil, in common with other conditions of vegetable growth, the *cause*.

So very simple did these general principles appear to those by whom they were first perceived, that they predicted a speedy development of the art of agriculture, under a science that embraced them. A soil-analysis would give the agricultural resources of the soil. An ash-analysis would make known the demands of crops upon soil. And a manure-analysis would show how much manure must be added to produce a certain amount of grain. With this knowledge, it would be only a matter of simple calculation with the farmer, to determine precisely the substance he must supply to each field according to the crop he has grown, and its quantity, to restore its original fertility. He would be able to express in pounds and ounces how much of this or that element he must give to the soil to restore it to its original fertility, or prepare it to produce another crop of any given kind of grain or other product he may desire to raise. There is a semblance of plausibility and sound reasoning about

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these ideas, which are better calculated to interest the reader and impress him with the *wonderful knowledge* of *scientific men* than to give him any correct views of agricultural science.

But I have already dwelt too long on the scientific branch of this subject. It is too complicated to be fully comprehended and acted upon, in all its various ramifications, by the average farmer. Yet he may derive much benefit and many useful lessons from its study, and by practical experiment may become a successful if not strictly a scientific farmer.

Do not understand me to disparage the researches, or detract one iota from its importance, or the vast benefit it has been to agriculture. But in my judgment scientific men have carried the thing a little too far; have figured it a little too fine to have all the theories, by them advanced, successfully practiced and carried out by our common farmers.

Now to the farmer who is short of barn-yard manure, and has thoughts of buying some one of the numerous patent fertilizers, we would say, that, by the following process, he can manufacture a cheaper, if not a better, fertilizer than a majority of them: —

1. Collect all the bones about your premises; put them in a tight plank box; then to every hundred pounds of bones, take forty pounds oil of vitriol, add to it an equal amount of water, and pour it upon the bones; let the mass stand for some days, the longer the better, and it will be ready for use.

2. Mix fresh pounded bones with carbonate of potash, or wood-ashes. Carbonate of lime and soluble phosphate will form; and after standing from six to eight weeks, the mass is ready for use.

3. Another plan recommended is to throw the bones into a hole with decomposing manure, decayed dead animals, or any similar substance; let them remain from three to six months, and then haul out together; the bones will be decomposed.

In all cases, care should be taken to let no bones be wasted. They are as important a part of the product of the farms as the wheat in the granary, or hay in the mow. But the manufacture of all chemical manures is attended with more or less expense, and, although their wonderful fertilizing powers are flaunted

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before our eyes in every newspaper we look upon, and are vouched for by "scientists" all over the country, still we are of the opinion that barn-yard and home-made manures will never be superseded or excelled to an extent that will compel us to abandon them as the main dependence of the New Hampshire farmer in furnishing food for his crops or fertilizers for his farm, and that they will always remain cheaper, if not better, than anything to be found in the commercial world. There are a thousand ways in which we may economize and increase our manure-heap. It is true, our chief source of supply is the excrements of our domestic animals. We say "chief source," for while these form the base, substances which are always at hand in greater or less abundance upon every farm should be utilized. It is often said, and perhaps with truth, that the liquid portion is fully equal to the solid, from most of our domestic animals. It should therefore be utilized with care. A barn-cellar is indispensable in the manufacture and preservation in their fullest strength and purity. Our domestic animals' excrements should all go into the cellar together, and occasionally muck, loam, leaves, sawdust, or some substitute, should be added. The swine should also be turned upon it, and allowed to exercise their fertilizing powers. They may be occasionally stimulated in their work of composting by strewing corn upon the manure. If they do not go to the bottom they may be inclined to do so by punching holes in it with a crow-bar, and filling them with corn. Under no consideration should this manure be removed until we are ready to use it, and the quicker it is covered by the soil when drawn out the better.* A great mistake is made by some farmers in drawing out their manure in the fall and heaping it in the fields. At least one-half its fertilizing properties are lost by the time we are ready to apply it in the spring to the soil, from drenching rains, dissolving of salts, escape of ammonia, etc.

All stock that comes to the barn-yard during the summer should be stabled, and under each animal should be spread

* Science, confirmed by practice, says, draw out and spread your manure when most convenient, unless it be put on land subject to wash. We recommend to draw manure in the winter and spread it on the snow on level ground. Results from such practice have been excellent. — Sec.

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loam, muck, or something of the kind, to the depth of at least four inches. When they are turned out in the morning, such portions as have been saturated with the liquid, or incorporated with the hard portions of the excrements, should be carefully scraped together and dropped through the trap-door into the cellar beneath, and its place supplied with more loam for the next night. In this way each animal will make from one to two bushels of excellent manure every night, and nothing that is valuable will be lost. In order to have this business faithfully performed, a good supply of loam or other suitable material should be provided and heaped up in the stable, or at as convenient a distance as possible, and a good wheelbarrow and shovel always at hand. Manure prepared in this way, after it has been worked over by the swine, is very superior for top-dressing on grass-lands, and may be profitably applied any time after haying, until snow falls. It is also just the dressing to be applied to English turnips, which for fall and winter use should be sowed from July 20 to August 10. They are easily raised, and are a valuable auxiliary to the winter stock of food, for either cattle or sheep.

Another valuable article is the droppings of the domestic poultry, and how often is it allowed to go to waste. Experience warrants us in saying that when properly fed and cared for, they will yield a direct profit in eggs, and will also furnish a valuable addition to our stock of fertilizers. A proper room should be provided for them, and beneath their roost the floor should be covered to the depth of two or three inches with loam, muck, lime, ashes, or, what is better, a mixture of two or more of them, and as often as once a month a small addition should be made to it. In the spring the accumulated mass beneath the roost should be thoroughly mixed, with the addition of one bushel of plaster to ten of the compost. In this way one and one-half bushels of very superior manure may be made from each fowl kept, and this compost will be found of greater value than most commercial fertilizers.

The privy, too, may be made to materially increase the stock of fertilizers. It should be made secure against the admission of surface water, and be supplied as occasion requires with quick

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lime, or other deodorizing material, and the whole be frequently removed and composted. The night-wash from the chambers should be thrown upon the manure-pile, or should be poured upon partly filled casks of muck or other absorbent, and additions made to it as often as it becomes thoroughly saturated, until the casks are full; and when this is the case others should be supplied. In this way a large mass of excellent compost is formed.

Time or space will not allow of our further discussing the various auxiliaries of the compost-heap that abound on the farm. We therefore pass others in silence, such as sink-slops, decaying animals, and a great variety of other refuse matter, none of which should be lost or neglected.

In closing, let us suggest to the farmer the importance of keeping in store, for almost every day's use, lime, salt, gypsum, wood-ashes, muck, mulch, or mold, leaves, saw-dust, etc., etc., and to use them freely as occasion may require. In this way we shall in a very short time be convinced of their utility and importance, and luxuriant crops will attest their value and cheer us on in our chosen avocation, while we renovate and beautify our rural homes here in the heart of our beloved New England.

SHEEP-HUSBANDRY.

BY WHITE MOUNTAIN GRANGE, LITTLETON. — C. W. BEDELL, REPORTER.

The discussion was opened by Brother William Harriman, who gave a sketch of his experience in sheep-raising. His principal business is producing milk for the market, but did know something about sheep-raising; bought a cosset lamb for fifty cents, kept it six years, and sold the increase for thirty dollars; thought sheep good to renovate pastures.

Brother Marshall Dodge. — I bought thirteen sheep; sold wool and lambs enough from them in one year to pay for them, and had a few dollars left; raise one hundred per cent of my lambs and sometimes more; fed corn to my sheep one year, lost most of my lambs, and have not fed corn since; feed oats

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instead; feed in spring; prefer Southdowns, as they are very quiet and are good mothers, and mature early for the market. When wool is low, sometimes keep it over until the next year and think it paid me six per cent for doing so; never kept it but one year at a time; don't believe in having sheep and cattle run together; think sheep should have water in the pasture in the summer as well as in winter.

Brother John Farr had eighteen sheep last season; raised twelve lambs; had four killed by dogs; sold sixty dollars' worth of wool and lambs; think six or seven sheep will consume as much as one cow; think a mixture of Cotswolds and Leicesters the best adapted to this locality.

Brother Frank Walker. — I have had but little experience in sheep-raising; if a man has the kind of a farm that is adapted to sheep, they are more profitable than neat stock; think seven sheep will consume as much as one cow; think we would get more profit from the sheep than cow, as butter has been the past season, and would get it with less work.

Brother Amos P. Wallace used to keep sheep; kept about thirty; think they paid me better than any other stock I kept; kept them in a pasture where there was water but part of the time; thought they did quite as well as they would if there had been water all of the time; never grained my sheep in winter; fed good hay.

Brother George Abbott. — Think sheep more profitable than other stock; they should have a pasture adapted to them; should select best ewe lambs to take the place of the old ones that die out of the flock; think it is as much work to take care of sheep as cows; think it is as necessary to have water in pasture for sheep in summer as it is to have it in the yard for them in winter; think Southdowns the best breed to keep.

Sister Farr. — I think if Brother Abbott had to work up his wool as the women had to in years past, perhaps he would be justified in saying it is as much work to take care of sheep as cows.

Brother Abijah Allen. — I think sheep the most profitable of any stock to raise; if one has good luck in raising colts and can sell them when about four years old, there is more profit in rais-

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ing horses ; but there are a great many uncertainties in raising horses for sale, and there is no income from them until sold, where in sheep we get two incomes in a year and the cash comes when most needed to pay our taxes and other little bills, and the lambs go off about the time we want to pay our hired help. Think a cross of Cotswolds and Merinoes full as good as any we can get ; they shear heavy fleeces and are good mutton sheep ; select the best ewe lambs to keep my flock up, and sell the poorer ones to go to market ; think it is very essential that they should have plenty of good water in winter ; let my cattle, sheep, and horses run together ; think it is better for the pasture.

Brother C. W. Bedell. — Have kept sheep for the last fifteen years ; had some experience in the sheep business ; find it is quite a trade to learn ; have learned that it don't pay to keep poor lambs to breed from ; tried that the first year I kept sheep and then gave it up ; since then I select from one to four of the best ewes and let the butcher have the rest. I wash my sheep ; shear them in June ; put tar on their noses to keep off the flies ; repeat once in about four weeks through hot weather ; think by doing so they will not be troubled with the grub ; let my sheep run to pasture as long as the ground is bare, and let them go again in the spring as quick as the knolls get bare ; think they do better than to keep them shut up ; feed no grain in winter ; feed grain in spring as soon as they get to the ground ; feed corn and oats, half each ; keep them near the barn and put them up nights while dropping their lambs, which is about the 20th of April, and always have my bottle and rubber nipple ready for use ; average to raise as many lambs as there are ewes that have lambs ; sometimes do better than that ; don't think it is necessary to have water in pasture for sheep in summer ; the dew on the grass will supply them with water while they get their living on the ground ; when fed hay, think a plenty of good running water indispensable. As for the best breed I am not prepared to say which is best ; once bought pure-bred Leicester buck and kept him two years ; he proved a failure ; sold him and all of his lambs ; have had grade Leicesters and liked them well ; used pure-bred Southdown one year and had good lambs ;

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they do not shear as heavy as Cotswolds or Leicesters; have used grade Cotswold bucks; lambs are hardy and good shearers, but good care and good keeping will keep up any breed.

THE IMPORTANCE OF VARIOUS KINDS OF STOCK TO THE FARM.

BY MERRIMACK RIVER GRANGE, CANTERBURY. — J. O. LYFORD, REPORTER.

At a meeting of the grange held Tuesday evening, March 23, the above topic was discussed by various members.

Col. Clough opened the discussion by a reference to its importance, and commented on the little attention given it. The relation of stock to the farm is twofold, direct and indirect; direct in the returns it gives in dollars and cents, and indirect in its increase of the manure-pile, and consequent growth in the fertility of the soil. If the farm is to continue to yield its rich increase, it can only be by keeping it well stocked. The sale of hay, of corn, and of other crops may bring more immediate capital, more ready money, but it is a sure road to the poor-house. It is with farming as with any other business; there must be a continual re-investment of capital. A farmer who knows how to buy, feed, and sell stock, can, in the long run, put more money into his pocket than by any other method of tilling the soil. So much for generalities. Now in regard to the kind of stock; one rule will not hit every case. A consideration must be given to the location, to the character of the soil, and to the conveniences. But there is one maxim which every farmer can follow with profit, — "Stick to your text." Don't, because wool is high one year, sell all your other stock and invest in sheep; nor, because wool is low, sell all your sheep; for if you do, unless you have more than ordinary shrewdness, you will find yourself just one year behind the market demands. Keep some sheep, some neat stock, some hogs, some hens, and just as few horses as you can get along with. Then you have something to sell, no matter how the markets stand. Keep all the stock you can, and if you have not hay enough, eke it out with corn and corn-fodder.

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These two crops enabled me to keep as much stock the first three years I was on the farm as my hay. If your fodder is coarse, keep young stock principally. Change stock once in three years, and where a change is made as often as this you cannot afford to go into fancy stock. Give more attention to sheep-raising, as a rule. There may be years when it will not seem to pay as well as some other kinds of stock, but in the long run it will be found profitable. Get a breed that makes good mutton and produces good wool. The sheep interest will not decline so that their rearing will be unremunerative. Every indication points to better markets and greater demands. There is only one drawback, and that is the dogs. But let us hope that the legislature will make the tax on this animal so large that only the rich men can afford such luxuries.

Mr. Edward Osgood coincided with Col. Clough in the points he had made, and said a farmer wants some hens because they are profitable. They bring in an income with proper feed and care. They are of great value about the garden in picking up worms, grasshoppers, etc. A farmer needs swine to eat up the refuse of the kitchen and dairy. Should prefer the Berkshire breed. Sheep should be considered with reference to the expense of fence, the location of the pasture, and the feed of winter. Cows we need, and oxen we should have for work, and these should be selected with reference to the particular branch of farming we intend to make special. We had better raise our own calves, and in breeding select with due regard for the point of excellence we wish to attain. Horses we should have for our own use, and we can occasionally raise one to sell with profit; but the average farmer in New Hampshire cannot do much at raising horse-flesh for the market and making it a specialty. Above all things else, let a man keep the principal part of his stock of that kind that he likes to take care of best. This will be his pride, and here his interest will center. For "where your treasure is, there will your heart be also." Regarding the kind or breed of neat stock for the farm, that is a question which every farmer must solve for himself from his location, his aim, etc. I have had good results from crossing Devons with Herefords, a Hereford sire with a Devon dam. A cross of Durhams and

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Herefords is also a good one, as is that of a Devon with a Durham. But good sires and good dams of any good breed will produce good stock, and the question we need to settle first is, what shall we breed for? This point determined, make selections accordingly. Throughout, endeavor to improve the quality of your stock, whatever point of excellence you seek to attain.

William P. Small was the next speaker. He believed that farmers should keep a variety of stock. Preferred Southdown sheep to any other breed for two reasons, — they winter better and bring up lambs better. Feed twice a day on meadow hay, varying it once a week with a good foddering of English hay. About the middle of March I commence to feed once a day with a few beans. They are in good marketable condition when it comes time to sell. I have not made three bushels of orts this winter, and I believe sheep and all kinds of stock do better to eat their food clean. Whatever the market demands is the best kind of neat stock, because it pays better. It is not always the heaviest ox that brings the most dollars. It is that one that has the most good points. I believe that a cross of the Herefords and Shorthorns is best. The Devon and the Hereford also make a good cross. The Devons are not good growers, while the Herefords are, and the cross of these two makes an even growth.

There is a mistake made in feeding calves for the first year and a half. They should be kept growing, and have some grain the first fall and winter. Afterwards they will do well on poorer fodder. A mixture of good and poor hay will keep them thriving. I feed some poor hay to all my stock. One great difficulty is we don't cut hay early enough. Believe we should keep all the stock we can and keep well.

John P. Kimball said we want some of most all kinds of stock; hogs and a good bed of muck for them to work upon; horses to do our marketing; good, close-built animals to work on the farm. If we can afford it, keep a driving-horse; but that is a luxury rather than a necessity. We need a few sheep. Have crossed Cotswolds and Southdowns with good success. The Hereford neat stock is the best for me. I can get them fat younger, and better beef at an earlier age. If we are going to

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keep anything, keep it well. In feeding cattle at the barn we make the mistake of keeping too many. Every creature should gain while at the barn at least six inches in girth. They must be fed some grain, and we must raise more corn.

P. C. Clough said that in his belief farm stock was as essential to good farming as food to the hungry. We must first decide on the branch of farming we mean to pursue. It ought to be varied in this town. We need a good milch and good breeding cow, and a cross is essential. The best cross for stock and dairy purposes is that of the Durhams and Herefords. Feeding is essential, but it is not all. We should turn stock as fast as possible. Should especially feed well in the spring of the year, even if we are obliged to buy meal.

George Fletcher thought there was danger of going to excess in raising stock, of taking one hobby and riding it to death. Horse-flesh has been the ruin of the farm, and the men too. He advocated the use of oxen for work on the farm in preference to horses.

Col. Clough said that stock should not be fed too early in the morning, nor too late at night. If there is a large amount of meadow hay of a poor quality to be eaten up, cut it up, steam it, and put on meal. Believed it paid to cut and steam all the food. Nothing was worse for cattle, especially young cattle, than to stand all day without drink, and then partake freely of cold water. We never should go to Canada to buy stock. It is far better to purchase nearer home, where we are acquainted with the stock. In all things connected with our farming operations, let us exercise good, wholesome common sense, and bring to our work all the intelligence we can command.

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MILK.

BY NARRAGANSETT GRANGE, BEDFORD. — GEORGE H WIGGIN, SECRETARY.

Being located near Manchester, the best market in the State for milk, we naturally turn our attention to milk-raising as our best source of income, although other branches of farming are by no means neglected, — market-gardening and fruit-raising being the principal business of many of our farmers. A careful estimate was made a few years since of the amount of milk sent to the Manchester market, and it was found that Bedford furnished one million and ninety-five thousand quarts annually, or three thousand quarts per day. In addition to that, we now send to Boston daily about one hundred cans, or eight hundred quarts. This is not all the milk produced here, as many families make their own butter, and there is quite a large amount of butter sold, so you can see that Bedford is quite a place for milk.

In raising milk for market, there are several things to be considered. First, the cows; second, the feeding; and thirdly, the care.

We do not raise many of our cows, perhaps not as many as we ought. The most of the milk-raisers keep as many cows as their farms will carry, and think it better to buy the best cows they can get than to raise them. When our cows on account of age, or from other causes, refuse to pay a fair profit, we fatten them and they are sold for beef, and we get nearly enough for them to buy a good milker. We consider grade Ayrshires and grade Dutch the best cows for our purpose. We think we get as much milk from grades as from thorough-breds, and can buy them at much lower price.

In feeding our cows, we turn them to pasture as early in the spring as we can, generally about the first of May, and feed in the barn morning and night. When pasture feed is at its best, we feed nothing except what they get in the pasture. When feed begins to get short, we feed green corn, or other green fodder, to keep up the flow of milk. We plant corn at different times, to have a supply until the frost comes, and if we have more than

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we need to feed green, we store it for winter use, and it makes very good fodder.

In winter we feed hay and grain. We sow a great many oats for winter feed, and cut them before they ripen, and many think they are better than hay for making milk. We sow about three bushels to an acre, and they grow thick, and are tender and juicy. We also raise Hungarian grass, and think that good. These, with our corn-fodder, make a variety of food which our cows relish, and is better than feeding all hay.

The most of us feed our cows three times a day, although some think that two times is better. We give them what hay they will eat in the morning, and then a feed of grain, — corn-meal and shorts, and perhaps some cotton-seed meal. At noon, hay or oats, and at night hay and grain. Many farmers have water in their barns, where the cows can drink whenever they please; it saves driving them out in cold and stormy weather, and adds greatly to their comfort. We consider it of great importance to keep our cows warm in winter, and think the temperature should not be lower than fifty degrees.

Cows should always be fed regularly, and milked regularly. It should always be done by the clock, and never let the time go by without doing it.

The barn should be kept clean and neat. A little dry sand or sawdust scattered under, and behind, the cows, keeps them dry, and prevents all bad odors. And if the barn is cleaned out two or three times every day, as it should be, and the cows are carded and kept clean, they look well, and feel well, and do well, and their milk gives good satisfaction to the consumer.

LITTLE THINGS.

WARNER GRANGE. — BY CHARLES CURRIER.

Our lives are made up of little things. Our successes are the result of a knowledge and performance of a multitude of little things. Our failures result from inattention to details or little things. Little things play a very important part in all the rela-

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tions of life,— in our homes, in our business affairs, in our relations one with another, and in our happiness.

Those who are waiting to do some great thing to lift them to wealth, fame, or happiness, will most likely be sadly disappointed in their expectations. These come through a knowledge of, and attention to, a large number of little things, — little thoughts, little acts, little words, little kindnesses, little sympathies, little sorrows, little pleasures, and little pains.

How many little things do our wives have to do and see to every day to make our homes pleasant and enjoyable. They have to sweep and dust and scrub, and wash the dishes and wash the floor and black the stove and skim the milk and scald the pans and work over butter and prepare it for market, and bake and boil and fry and stew and broil and set the table and sew on buttons, sew up rents, mend mittens, bind up little fingers, settle little differences, soothe little sorrows, create little joys, guard and direct little minds.

And what an influence she exerts through the faithful performance of these little duties. And how many little things do they have to know and attend to in getting up our nice dinners. Now any one can get up something to eat; but to get up a nice, daintily served dinner, one that all the brothers here would appreciate the charms of, requires something more than the mere mechanical operation of combining heat and raw material, — a little knowledge of chemistry to know the fixed results of the combinations of different ingredients; a little philosophy to understand the effects of heat upon raw material; a knowledge of, and attendance to, all those little things necessary to know and do to set it before us in a nice, beautiful, and acceptable manner. A frugal repast tastily served, is more charming than the richest viands served in a slovenly manner. And what a nice discernment of the fitness of little things is required in arranging and adorning their rooms to make them pleasant and instructive, that beauty of design and usefulness of purpose may be harmoniously blended.

And what an influence these nice, tasty arrangements have upon the minds of all the members of the household. They

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acquire, unconsciously, a refinement of taste which can be imparted in no other way.

Let us, then, endeavor to know and practice all these little things that make our homes beautiful and pleasant. Elegance and wealth are not necessary companions. By the exercise of proper judgment and a little efficient advice, the poorest home may be made to teach its lesson of harmony and taste.

And then the men have some little things to do or not to do, to make home pleasant. Wife could tell what they ought to do better than I can. I will tell what they ought not to do. Husbands need not have a wet blanket for every little plan the wife is making to obtain some little things that will add to the comforts or pleasures of the family. They need not sit down to the table and turn up their noses and ask if this is all they have to eat. They need not carry their petty troubles into the house. Our wives have their troubles and trials as well as ourselves. If we have any fretting to do, let us do it outside. They need not use any unkind words in the house. A stone thrown in the well will cause a commotion in the water which will soon subside, and all will be tranquil again, but the stone lies at the bottom. So with unkind words, they leave their scar. They need not withhold praise when due, and feel that discipline must be maintained. And when she wants the money for a new bonnet, don't be so simple as to ask her if the old one won't do a spell longer.

To know how to do a thing well, or to do it in the best possible manner, involves a knowledge of a multitude of little things. We cannot be successful in any business or occupation without a knowledge of, and attention to, the details of that business.

If we should go to the successful manufacturer or railroad manager or financier, and ask them the secret of their success, they would tell us it depended largely upon their knowledge of, and attention to, details. Now it seems to me there is no business or occupation that depends so largely for success upon little things as does the occupation of farming. And yet we farmers do not studiously strive to acquire a knowledge of those little things necessary to our success. We are guided in our operations more by habit than knowledge, and if at the end of

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the year we by hard labor and rigid economy have succeeded in making buckle and tongue meet, we think we have done pretty well. And if we reach this result we do not know if this is only pay for labor expended, or whether we have received interest on our capital. We have no figures to show us. We do not know whether this product or that has paid a profit, or whether some one product has paid a profit large enough to balance losses on all the rest. How would it be possible for us to be successful in any business if we conducted it as we do our farming operations? Did we ever see or hear of any one being truly successful that did not know what his productions cost him? We say it would make no difference with us if we did know how much they cost, we should go along about the same. Well, perhaps we should. Now, if we should keep a debt and credit account with the farm, and we found at the end of the year or a series of years that some of our products had paid good profits, and the others had not, should not we be likely to make something of a specialty of that which paid the best? And, again, if the figures should tell us we had hardly received pay for our labor, would it not lead us to make a little judicious effort to find out the cause? We might be led to ask ourselves if the crops and stock we raised were those best adapted to our tastes, conditions, and circumstances, if we raised the best that could be raised, and if we raised it the cheapest it could be raised.

Now we ordinary farmers go along year after year making mistakes without knowing it. We do not know whether we are getting those returns for our labor and capital we ought to or not. We simply know our expenses are large enough to eat up all the money we can get hold of.

There are some farmers who are successful; they make a good living, and lay up some money for a rainy day. Their conditions are no more favorable than our own. But these successful farmers are men that know when they make mistakes, and know how to correct them. They learn from their mistakes as well as from their successes. They know the cost of their productions. They do not guess at anything; they know by figures all the items that enter into that cost. They do a little head work and do not depend entirely upon muscle. They know which prod-

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uct pays the best and make a specialty of it, and studiously strive to know and practice all the little things that will perfect it and make it yield the largest return.

When we see, or read about, successful farmers, we find they have kept a debt and credit account with the farm, and in most cases have made a specialty of some of the productions of the farm. I do not mean that they have confined themselves to the raising of one particular product, but that they have studied to know all the little things necessary to know to successfully raise some particular product.

It is better to know how to do some one thing well than to have a superficial knowledge of a great many things. When I go into my neighbor's barn and see his cattle and sheep (under no more favorable conditions) looking fatter and sleeker than my own, I say to myself, he knows some little things about cutting and curing his grass, or in tending his cattle, that I do not know.

When I read about farmers' raising seventy-five or a hundred bushels of corn or forty bushels of wheat to the acre, I think to myself, they know some little things about raising these crops that I ought to know.

When I read about Mr. Stowell of Vermont, who sold ninety sheep for six thousand dollars, I decide in my own mind that he has studied sheep-husbandry. Now why cannot the farmers of the town of Warner, as well as those of other localities, produce some of these large crops and raise some of these nice cattle and sheep? Is it because our conditions are less favorable? Are our abilities inferior, or have we acquired a habit of being satisfied with medium productions, and do we need some powerful incentive to stir us up to make an effort? Some will say we have not the means to do these things. This is no reason; where there is a will there is a way, and men of moderate means oftener succeed in these things than do those whose means are unlimited.

Brains take the lead in the successful management of the farm, and not muscle. A little well-directed effort will accomplish more than a large amount of labor without definite plans.

I can look back upon my twenty years of farm life and see many mistakes. I can see where a little figuring, a little atten-

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tion to little things, a little brain work, would have produced much better results than has an unmerciful amount of hard labor.

And how much of pleasure and happiness depends upon little things in our relations one with another, — our pleasant looks, our kind words, our sympathies, our sorrows for their disappointments, our words of encouragement and praise.

> "A single word is a little thing,
> Yet a soul may be dying before our eyes,
> For lack of the comfort a word may bring
> With its welcome help and its sweet surprise."

These little things gold may not buy, but the poorest of us may offer them whenever we will.

THE ADORNMENT OF FARMERS' HOMES.

BY ADVANCE GRANGE, WILTON. — MRS. A. D. ABBOTT, REPORTER.

Worthy Master G. L. Dascombe said, perhaps there is nothing in which there is a more marked contrast between the status of the farmers of New Hampshire at the present time and those of fifty years ago, than in the matter of the adornment of their homes. At that period their houses, with rare exceptions, were almost entirely destitute of anything which could truly be called ornamental. The "pictures" which hung upon the walls consisted mostly of profiles of members of the family, cut out of paper and placed against black cloth and put in the plainest of wooden frames. If there were others they were hardly superior to these in artistic beauty There were no house plants except "olive plants," which were far more numerous then than now, and scarcely any flowers around the dwellings.

And yet the æsthetic taste was not wholly dormant. It was manifested occasionally by the farmer's wife in the attempt to relieve the bareness of the walls and furniture by arranging around the mirrors and the tall clock-case sprays of asparagus (which was not then cultivated as an edible plant, but only for the purpose of ornament), and by other simple means. Some

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were fortunate enough to obtain a few feathers from a peacock's tail, which were conspicuously displayed about the looking-glass in the parlor. The hard struggle to win a subsistence from a stubborn though not sterile soil, left little time to develop or to gratify the love of the beautiful. And the good wife, with her endless labors and cares, had still less time to devote to this purpose than her husband. Even twenty-five years ago but little advance had been made in this direction. I remember the case of a minister who declined a call to settle in a parish solely on the ground of the neglect of the people to give to the surroundings of their houses and their church an appearance of neatness and beauty.

Since the introduction of machines has lessened somewhat the severity of toil, both on the farm and within the farm-house, more thought and attention have been given to this subject. But as yet only a beginning has been made. The development of a refined taste is one of the means by which farmers and their families are to win their way to a position of *recognized* equality with those in the other walks of life.

The income of the average farmer is not sufficient to allow any very costly embellishment for his home; but there is one method of adornment, perhaps the best of all, which is inexpensive and within the reach of every one, — the cultivation of flowers, both within and around the house.

No Patron of Husbandry can have failed to notice how much stress is laid upon this matter in the instructions of our Order. To these instructions we shall do well to give heed. What more pleasant spectacle can be presented to a person as he passes along the street on a wintry day than the gorgeous hues of flowers seen through the windows of the farmer's cosy sitting-room? And how much of pleasure is afforded to the occupants by an affluence of flowering plants and creeping vines.

And not only do they afford pleasure by the beauties which they present to the eye, but they are often of real, practical utility. Many a farmer's wife sinking in despondency, resulting from ill-health and overwork and carking cares, has found in the culture and care of her plants a recuperative influence which

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has saved the payment of physicians' fees, and perhaps of undertakers' and sextons' bills.

Brother G. H. Keyes said if he were a young man he would first get a good wife to adorn his home. Then have an abundance of flowers. Know of nothing that adds more to the good looks of a place than a large, nicely-kept flower-garden. Another thing, which I do not pretend to fully carry out in my practice, is to keep everything cleared up about the premises, not allowing rubbish to accumulate, but have a place for everything and everything in its place. Much may be judged of a man's character by the general appearance of his home. And I think it important that every farmer should have a good fruit-garden, where all kinds of fruit should be cultivated.

Brother Charles Wilson said he had always admired tidy, snugly-kept homes, and could remember certain places that had always impressed him by the remarkably neat appearance about the buildings. He has been, and still is, ambitious to have everything about his place in good order, but finds many hindrances.

Brother James Sheldon indorsed Brother Wilson's ideas, but thought much depended upon location. That it was not possible in all situations to keep the farming utensils and all that may be called rubbish out of sight.

Brother Henry Gray would concur in what had been said by other speakers. He would seek a good wife, and then be particular to work harmoniously together. If there were children in the family, they should be carefully trained, that they may become good and useful members of society. Too much importance cannot be attached to the early education of the young.

Sister Matilda P. Wilson. — I don't know as the subject refers wholly to the grounds about the house, or whether the interior of the house claims its due share of notice. It is of this I wish to speak, although I especially admire well-kept grounds and fine shade-trees. I wish to speak of one element we can all have in our homes, yet I fear it is not equally appreciated by all of us. It is sunlight. Give me a plain, unadorned home, with the sun's rays dancing in every apartment, speaking to me so sweetly of God's great love to man, or give me tapestry car-

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pets, fine paintings, and the most dainty upholstery, if they are all too nice to be exposed to the sun's rays and I must deprive myself of this health-giving element, and I would not hesitate a moment in my choice. It would be in favor of the plain home. A little knack will help wonderfully in fitting up a home tastefully and with small expense, and give all the comforts that wealth could procure. Many useful articles are manufactured at trifling cost, which add very materially to the comfort and cheer of home, and are within the reach of all.

Sister H. M. Mitchell. — First in my mind is the farmer's house, though it need not necessarily be a large or beautiful one, to be neat and attractive. Paint and blinds add greatly to the looks of our homes, and there are but very few of our New England farmers who cannot afford to keep their buildings well painted, both inside and out. And wall-paper is so very cheap, our rooms need not look shabby for want of new paper occasionally. Now we have got the house nicely painted and papered, we will take a stroll out in the woods (providing it is autumn), and gather some of those beautiful maple leaves, also some sumach, and an abundance of ferns, with now and then a leaf from the old oak and chestnut tree. These leaves can be nicely kept until we gather more another year, by ironing them in rosin, and the ferns need pressing till dry to remain beautiful. Our leaves and ferns all ready, let us exercise a little artistic taste in arranging them around our rooms, and we shall have a home that is truly attractive. Now we will not close the blinds and keep the blessed sunlight out, if it does fade our carpets and furniture, nor make our children sit by the kitchen stove for fear of disarranging something in our "best rooms," but rather make them understand 'tis done for their enjoyment; for what can our children take with them, as they travel the different paths in life, more pleasant than the remembrance of a kind and happy home. How much more attractive our country homes might be, did we have a nicely-kept lawn, with a few trees and flowers.

Sister Lucy R. Blanchard. — How true it is, "Be it ever so humble, there is no place like home," and how important that we cherish and make the most of it. I have thought, since this

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subject of adorning farmers' homes was introduced for our consideration, that perhaps some of us may have felt that in this respect we had neglected to do our duty. We, as farmers' wives, know very well how fully our time is occupied with the common, every-day duties in our families, and must plead, as our excuse for neglect, a lack of means and time, not of inclination. If we are not able to adorn our homes with books and periodicals, ornamental furniture, cheerful carpets, and fancy work, let us bestow upon them, in abundance, a spirit of contentment and cheerfulness, and a self-sacrificing, unselfish disposition; in short, adorn our homes with love, and make them the dearest spot on earth to all the members of our household.

Sister Rilla L. Russell. — To a family of limited means, this requires considerable ingenuity; and yet, it is one of the essentials. If we wish to keep our children at home, we must make home as attractive as possible, so they will not be ashamed to invite their young friends to visit them. This does not require costly carpets, furniture, pictures, and statuary. I have been in parlors where thousands had been expended in furnishing, that did not give me half the pleasure I have felt in a cozy little parlor of a country farm-house. At the present time there seems to be a rage for ornamentation, and people are inclined to crowd their rooms with ornaments of every description, without regard to art or taste. A delicate wall-paper with a little trace of color, a few attractive pictures, tastily-bound books, with nooks and corners filled with brackets and other little things, made by ingenious fingers, from wood splints, straws, and other inexpensive materials, and a well-chosen motto or two, will make a room very attractive. Our woods and fields furnish us with plenty of material to aid in the adornment of our homes, in the beautiful frost-colored leaves, ferns, and mosses. In the flower season, no one is so poor but they can adorn their homes with flowers.

Carpets are not necessary to the beauty of our rooms. For a room in daily use, a nicely-painted floor, or one that shows the natural grain of the wood, is neater and healthier than a woolen carpet, especially in a sleeping-room. Indeed, if I could furnish a house just to my taste, with unlimited means at my com-

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mand, I would not have a carpet in it; but would have floors inlaid with different colored woods, partially covered with handsome rugs. This might be imitated by painted floors, but would be hardly practicable with us, as they would have to be renewed frequently, and would be more expensive than a substantial carpet.

In selecting pictures, I choose cheerful subjects. I cannot sit, with any degree of patience, in a room where there is a copy of Peale's "Court of Death," or the "Death-bed of Abraham Lincoln," that I have seen in many parlors. I well remember in my younger days of passing through a hall where hung a picture of David slaying Goliah. It cost a small fortune and was called a magnificent painting. Perhaps it was. I never stopped to look at it long enough to form an opinion. Such pictures are well enough in a picture gallery, where we expect to see all sorts of subjects, but are out of place in our parlors, where everything should be cheery and pleasant. Many of these things cost time and money that we cannot afford to spare from the actual necessities of life. But we can gather, in abundance, leaves, ferns, mosses, and evergreens, with which to adorn our homes in winter, and in summer nothing can be more beautiful than flowers; and of these we cannot have too many.

Sister C. A. Abbott. — Our idea of a model home is far in advance of our present attainments. What do we understand the word "home" to mean? Does it not mean more than the house that shelters us merely? Are not all the furnishings, the occupants, and the outer surroundings, a part of our home? *Why* should we adorn our homes? Dr. Holland writes, "That in the little communities which we call American homes, the hope of America rests." That being true for the whole, it is largely true for the farmers' homes for which we plead to-night. Our young people go out from us into life for themselves with our home influences about them. Let us make their home remembrances to be pleasant in the recollection. It is a practical question with many of us, "How shall we keep our boys interested at home?" A bright, attractive, well-adorned home will have no small power over them, we think. As far, then, as

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outward adornments can increase the attractiveness of our homes, is it not wise in us to seek to have them?

How should we adorn our homes? According to our means, time, and tastes, we answer. Many of us cannot add to our dwellings all the modern finishings in the way of bay windows, piazzas, or expensive architecture of any kind, yet we can train some graceful vine to cover its walls, and have grounds about bright with flowers. Beautiful pictures, too, may be in almost every family. Landscape chromos brighten a room wonderfully. As an instance of what a cultivated taste can do with very simple materials, let me give an illustration. Calling on a friend a few days since, the pleasant, cheery aspect of the room impressed me. And among the most attractive of the furnishings of that room were the window-curtains, plain pearl white, while near the bottom they were ornamented with clusters of autumn leaves and pressed ferns, with vines, also carefully pressed, running from them. The effect was beautiful. Not all, perhaps, possess that lady's taste in arranging things, but we can cultivate what we do possess. Let us then keep our home-fires bright, so that when our children and friends go out from us, it shall be with tender memories, and with a more purified and strengthened character to meet the conflicts of life.

Sister J. B. Abbott. — In considering the "adorning of our homes" some important questions present themselves. One of the first is, *will it pay?* That depends upon the benefit to be derived. If the principal consideration is *dollars* and *cents*, the answer will probably be in the negative, as it too often is. But if enjoyment in our homes for ourselves and others is the main object, we shall seek to improve our surroundings in every way we can. It is practicable that we should consider principally the inexpensive adornments for farmers' homes, as few have the means to provide other. But of these there is an almost endless variety, and in being obliged to depend so much upon our own skill and ingenuity, gives us some advantages over those who are favored with long purses and can buy all they may wish. Taste is cultivated, executive ability acquired, and we are better prepared to enjoy the result of our efforts by the labor it has cost us. Another question comes up quite as difficult as the

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first. What can I do to ornament my home with so much necessary work depending upon me? Think about it. Give the subject your attention and opportunities will multiply. Notice what your friends have been making and doing, and call the attention of your children to it. They will be interested in almost anything that is going to fix up the house.

Most of the inside adornments of a house may properly be called "woman's work," and it is really wonderful how much may be done with little expense, to give rooms a pleasant, attractive look. We New Englanders have made a great advance in this respect in the last fifty years; but we have not reached perfection yet. If the adorning of home were to be defined as anything which will make home attractive, we shall find the meaning so broad as to include many things not generally considered under this head, such as cleanliness and order. These cannot be classed among the ornaments for a home; but without this condition anything simply for the purpose of decoration seems out of place — or rather fails to produce the desired effect. And just here I would have outdoor improvements begin. Tidy up the yard, move back the old carts and plows, etc., to some place of shelter if you can; but if they must be kept out of doors, don't leave them in front of the house. In outside improvement, women unaided can accomplish but little. The cultivation of flowers is very unsatisfactory unless a suitable place is provided. She can paper and paint the walls of the house with good results, but in making fences and hanging gates to protect the flower-garden, she is quite dependent. In beautifying a farmer's house, it is supposed that the entire farm is included. It is sometimes a question *where* to begin. I would suggest that some of the first improvements be made upon the buildings and in the vicinity of them, working toward the rocks and ditches, instead of the reverse order. We do not so much lack time, ability, or opportunity to adorn our homes, as we fail to attach due importance to the subject. People are not so insensible to the effect of their surroundings as they would sometimes have themselves and others think. All have more or less love for the beautiful, that can nowhere be better met and satisfied than in our own homes.

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THE FARMER'S DUTY.

KEARSARGE GRANGE, WILMOT. — BY MINOT STEARNS.

What is the farmer's duty, and how is he to perform that duty?

By divine decree, the earth was given to man to replenish and subdue, and the fish of the waters, the fowls of the air, and every living thing that moveth was placed under the dominion of man, and every herb bearing seed was ordained for food.

The toilers of the present, whether farmers or artisans, have received the earth and the fullness thereof from the generations of the past, to hold in trust, and to use as heritors, and to transmit the same unimpaired to succeeding generations as their heritage by divine right.

The conditions of occupancy imposed by Deity on man in Eden, are in force now and will remain binding so long as time lasts.

To perform his duty the toiler must practice diligent industry and frugal economy, ever putting his heel firmly on the head of every serpent which would beguile him from letting well enough alone, or that would delude him to attempt attaining happiness by a tower of human toil, or compel him to gather stubble instead of straw and then render the tale of bricks to idle taskmasters, or impel man to incur destitution to enable Aaron to build an altar before a golden calf, or infatuate man to prepare a crown of thorns for the brow of innocence. Whether the serpent be creeping and slimy, or be bold and arrogant like the Jewish priesthood, — the result of the fallacy is equally harmful.

To know what his duty is, the toiler has need to understand the relations of individual man to community, and of community to each individual, which embraces the polity of community and the means of promoting prosperity and happiness. History is replete with events adapted to instruct the intelligent mind.

The changed condition of the toiling peasantry of America in the last twenty years, seems to press upon the attention of the toilers the consideration of topics and questions which were

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but little considered a generation ago, — and not well comprehended now, — but bearing intimate relations to the farmer's duty and the performance of that duty for self-protection.

Some of those questions are, How is man affected by government, civilization, agriculture, or industry? Hard times, — what is the cause, and what the cure? Is there profit in farming, and who gets the profit?

Government, civilization, and industry are not synonymous terms, yet the three are so closely related that either two will suffer whenever the third is absent, and man prospers only when the three exist and prosper. The three comprise the trinity of earthly happiness.

Government is a compact in which all the powers of a people are blended, and vested in certain public functionaries, elective or hereditary, by whom those powers are to be wielded whenever and however is necessary for promoting prosperity; but it is sometimes perverted to promote personal ambition.

Civilization is the moral and intellectual improvement of man, causing him to have regard for the rights of others, — fitting him for social life and government.

Industry is the application of physical and mental abilities to secure a greater supply of the provisions of nature for promoting happiness. It is the foundation of civilization and government, and sustains all that promotes the welfare of man.

Much is, and for a few years past has been, said and written in our country about hard times, — a problem ever pressing for solution, and to solve which correctly, the prime factors must be included in the computation.

Many of the nations of the old world are agitated and the rulers are alarmed by the discontent existing among the toiling peasantry of those countries, — communism, nihilism, tenant farmers, and socialism haunting the visions of monarchs and titled nobility in those countries, and in our "land of the free and home of the brave" we have lately had a congressional committee perambulating the country to ascertain the cause of business depression, railroad riots, and labor strikes.

Like causes will produce like results.

Wealth is the surplus product of labor not consumed in the

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passing year, and consists principally of improved lands, buildings, machinery, tools, stock, and other conveniences of civilization which conduce to the comfort of man subsequent to the time of production, either directly or by making toil more efficient. Wealth is of slow growth, estimated by writers on political economy not to exceed about five per cent of the gross product of toil by the most frugal and industrious people in the most productive countries and best of times; the other ninety-five per cent being consumed in the passing year, the investments in homes and conveniences for comforts constituting the net gain of wealth in all countries.

Computation demonstrates that one cent at six per cent compound interest during the Christian era, 1880 years, would now equal an amount requiring nearly fifty places to write or express it in figures, the numeration of which would be incomprehensible. In value it would equal a solid pile of pure gold many trillion times the bulk of the earth, sufficient to construct a solid shaft of pure gold having a diameter the same as the earth's, and extending into space so far that light, which reaches the earth from the sun in about eight minutes, would require about two hundred thousand years to travel the length of that "golden street;" which shaft at the same rate of gain would be accumulating about twelve thousand times faster than light travels, and being accelerated in a geometrical ratio which would soon fill space and clog the universe with gold.

Computing the cost of the vessel and outfit used by Columbus in 1492 at five thousand dollars, — a modest estimate, — that at six per cent compound interest would now equal about three hundred thousand dollars to each man, woman, and child on the continent of America, including foreigners, paupers, and Indians; and by a similar computation the six hundred million dollars wealth of the colonies in 1776 would now equal about eight times the present wealth of the nation.

If the descendants of Noah had sold the first brick put into the tower of their folly, and invested the proceeds at six per cent compound interest, letting it accumulate till now, it would equal a large herd of golden calves for each descendant of Adam now on earth to worship and call his own.

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Three cents saved by a man each working day during fifty years, and yearly put at six per cent compound interest from twenty to seventy years of age, will amount to about four thousand dollars, — a fair competence for old age. Many will declare there is no profit in farming which does not permit a man and woman to save three cents net each working day of frugal industry; yet a majority fail to secure the four thousand dollars in a lifetime.

By the condition of mankind throughout the civilized world, it almost seems that toil produces poverty and suffering, and that idleness produces wealth and luxury.

Previous to 1860 the revenue of the federal government taken from toil averaged only about one dollar and a half annually per capita, or about seven dollars and a half for each family of five persons. Since 1865 the revenue in some years has averaged about twelve dollars per capita, or about sixty dollars for each family of five persons; and for all the time since 1865 the federal revenue has averaged about ten dollars annually per capita, or about fifty dollars yearly to each family of five persons, — about forty-two dollars and a half extra burden on each family yearly; or by compounding the excess for the fifteen years, it aggregates about ten dollars and forty cents for each family of five persons, in excess of the average exactions before 1860.

The three million population of the colonies had about six hundred million dollars wealth in 1776, and the thirty-one million five hundred thousand population of the country in 1860 had about thirteen billion dollars wealth exclusive of slaves, — being about twelve billion four hundred million dollars net gain in eighty-five years over the waste of war and the elements, — equal to about eight dollars and forty cents average annual net gain per capita, almost wholly in homes for the people, and nothing for interest on the labor of the past, or wealth.

As a punishment of the human family for heeding the delusive suggestions of a creeping demagogue, and violating a plain injunction of Deity, the ground was cursed, and infested with thorns and thistles to enforce the decree "in the sweat of thy face shalt thou eat bread," pronounced nearly six thousand years ago, banishing man from paradise, and dooming the race

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to perpetual toil and sweat, with a serpent ever at his heels, making "eternal vigilance the price of liberty;" and the logic of events in all the time since then proves that that decree is a fixed principle in the economy of nature.

Civilization was intended to mitigate the severity of that decree, and to ameliorate the condition of mankind by instituting compacts or governments with rules or laws to secure to each toiler, for subsequent enjoyment, the surplus products of their own toil, thereby transforming mankind from a horde of wandering barbarians exposed to the rigor and inclemency of the changing seasons, and the rapacity of superior strength, while obtaining a precarious subsistence, to social beings intent on securing homes and happiness.

Civilization operates to classify toilers, one class producing food and raw material, another class manufacturing clothing, tools, and all needed articles, while another class is employed to transport and exchange the surplus products of toil, thus constituting the trinity of industry, — agriculture, manufactures, and commerce, which, if containing the necessary moral and educational instructors, constitutes the only classes necessary to promote the prosperity of man.

The benefits of civilization to the toiling masses of mankind have often been defeated by the cupidity and avaricious schemes of financial ghouls, who in all times and countries, without toil and sweat, have managed to eat bread in idleness and to amass wealth while reveling in luxury on what was produced by the toil and sweat of others, thereby causing hard times, and the overthrow of many powerful nations of antiquity, and the decay of others.

The hard lot of man often impels to crime. Whatever increases the burden on toil makes the condition of the toiler worse, and whoever aids to increase the burdens on toil is chargeable for what is certain to result from that cause.

More than eighteen hundred years ago it was proclaimed that "the *love* of money is the root of all evil;" as true now as ever. "It is easier for a camel to go through the eye of a needle than for a rich man to enter into the kingdom of God," was evoked by the query of the lawyer who had kept all the commandments

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from his youth up, while reveling in large possessions filched from others' toil by ways and tricks that would "beat the heathen Chinee," and it was uttered to condemn the money-changing ring who made the temple a den of thieves (without rebuke from those sitting in Moses' seat), binding heavy burdens grievous to be borne on the shoulders of toil without lifting a finger to lighten the burden.

Agriculture, manufactures, commerce, with instructors and functionaries all in just proportion, all working to promote general prosperity, is the best-constituted human institution to secure prosperity and happiness.

In the old countries of the East fortunes were amassed and aggrandizement attained by proconsular pillage, predatory warfare, and piracy on the high seas. In the more modern countries of the old world a like result was secured by extorting rent service or rent charges from the toiling peasantry, and by levying tribute on every form of industry which would augment the revenue claimed by baronial nobility and stilted aristocracy as theirs by divine right.

Americans are easily convinced that those systems impelled millions of the people of the old world to become voluntary exiles from the land of their birth, leaving kin, friends, and the ties of home, braving the dangers of an ocean voyage for weeks, to endure privations, beset by ruthless savages in the wilds of America, that they might secure and enjoy liberty and homes, and bequeath them as a heritage to posterity. The structure of government in those countries had become too ponderous for the foundation. The feudal system of the old world vested the *title* to the soil in nobility, who permitted the peasantry to occupy the soil on feudatory tenure, by which system the nobility were enabled to fare sumptuously, and have massive castles built by an enormous expenditure of toil, very little of which was performed by themselves; while to maintain that system and repel the encroachments of neighboring nobility, the toiling peasantry endured privations and sometimes starvation.

The unjust discrimination of that system was incorporated in the national compacts which succeeded the feudal system in the progress of time, and now prevails in most of the countries

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of the old world, by which plebeians are oppressed and nobility is aggrandized.

The "New York Herald" was cited as recently stating that the nations of "Europe pay annually eight hundred million dollars for the rare luxury of being prepared for war," which means that the toiling peasantry of Europe must toil for nothing so much as will produce eight hundred million dollars, annually, at the beggarly rate of wages which prevails for the pauper toil of Europe.

In our country during the last thirty years or more, financial schemes and practices have prevailed in legislation and in the management of public enterprises, corporate and governmental, which have operated to create and aggrandize money-barons, enabling them to revel in luxury, and amass large fortunes from enormous incomes of tribute levied on the toiling yeomanry of the country by processes which operated to cheapen the compensation of the producing toiler, and enhanced the cost of products to the consumer.

The construction and equipment of railroads required vast capital, and their managements required an army of managers.

In the early days of railroad construction the savings of years of toil were invested by farmers and artisans, desirous of securing safe investments and sure incomes for old age; but the subsequent *mis*-management of those railroads very often defeated those hopes by establishing the control and eventually merging the title in those who were, at first, only employed to manage the affairs of the stockholders, after which stock-watering, combination, and consolidation, the trinity of corporate iniquity, were resorted to by railroad rings, thereby transforming a public franchise into a huge monopoly to oppress the industry of the country by exacting exorbitant tariff for transportation, and, with the income thus obtained, establish a lobby to secure special privileges, thus constituting the railroad system a more efficient aid of oppression than all the systems and practices of the old world by feudal tenure. (Pages 392, 393, Sanborn's History of New Hampshire, cited as illustrating.)

To build and equip the ninety thousand miles of railroads in the United States, probably cost about three billion one hun-

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dred and fifty million dollars, which, by stock-watering, has been increased to about six billion dollars capital stock, about nine-tenths of which is probably owned by less than one-tenth of the stockholders, those being men who have amassed enormous fortunes in railroad financiering.

The products of industry transported over the railroads of the country annually pay tribute sufficient to keep them in repair and pay all running expenses, and about five hundred million dollars for dividends or interest.

Taking one mile of railroad as the unit, the growth of the railroad system in the United States has been: —

To about	10,285	inhabitants in	1830	there was	one mile.
"	4,500	"	1840	"	"
"	2,675	"	1850	"	"
"	1,010	"	1860	"	"
"	630	"	1870	"	"
"	550	"	1880 probably is		"

The five hundred million dollars tribute for dividends, or interest, is about ten dollars per capita.

A corporation is an immortal body, created by human power, without a soul.

A lobby, created by a ring of corporators having mutual interests and backed by about five hundred million dollars annual income, becomes a factor in shaping and controlling legislation more potent with venal legislators than the rights of the people, and, by beclouding the mental and moral vision of judges and other functionaries, causes them to canonize the system and to proclaim that corporators who obtain a public franchise as trustee for the public have thereby acquired vested rights paramount to the public good, or the rights of individuals or communities; and that corporations, like a king, can do no wrong, having acquired by divine right absolute title to what the public only had the right to take the use of, for public good, and therefore can't be held amenable to mundane tribunals or laws.

The tariff rate charged by railroads often bears no proportion to the quantity and distance of transportation, Vermont farmers often paying eighty cents per one hundred pounds to have their

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butter carried to Boston, while butter is carried from Iowa to Boston for sixty cents per one hundred pounds; and traders in Cincinnati, Chicago, and other Western places often pay less than two-thirds as much tariff per one hundred pounds for freight from Boston to those places, as the traders along the line of the Northern New Hampshire Railroad must pay for freight from Boston.

A report of the Board of Trade, London, England, gives the cost, per mile, of conveying a train carrying three hundred tons, as sixty-three cents, which includes locomotive power, repairs and renewal of ways and cars, taxes, traffic charges, legal and miscellaneous expenses, and losses by accident, etc., — equal to about twenty-one cents for transporting one ton one hundred miles.

The manufacturing in our country is now mostly done by corporations with a vast amount of capital stock, the corporators of which are not content without large dividends of interest which is secured by combination, by which the wages of operatives are fixed at the lowest point to avoid a strike, and the price of manufactures is fixed at the highest point possible to compete with manufactures from other countries, while the same goods are put into foreign markets in competition with goods of those countries, and that with the advantage of tariff duty reversed.

An item from the "Boston Herald," Dec. 29, 1879, stating that "The First National Bank of New York city, on a capital of five hundred thousand dollars, has made the enormous dividend of one hundred and twenty per cent, after adding five hundred thousand dollars to its surplus and also leaving two hundred and sixty-seven thousand and seven hundred dollars undivided in its profit and loss account," and the fact that legislation in New Hampshire exempts deposits in savings-banks from taxation without giving every person the right to loan money on real-estate security at the deposit rate of interest with a like exemption from taxation, are offered as proof that the polity of government and legislation for many years has been farmed out to political syndicates, in whose hands partisan politics have degenerated to a huge scheme much like the tricks of child-

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hood wherein the credulity of inexperience is coaxed to "shut the eyes, open the mouth, and swallow" for the amusement of more advanced playmates.

Good people are shocked at the mention or thought of usury, gambling, lotteries, liquor traffic, pinchbeck jewelry, gift enterprises, and other nefarious schemes for obtaining Esau's birthright for pottage without rendering a fair equivalent, and the gainer by such practices must be punished as a felon to placate the modern Pharisees in and out of the sanctuary who strain at the bare thought of such practices on the outside of the moral dish, but swallowing the grain blockade, Black Friday, Credit Mobilier, whisky ring, coal combination, and speculating "corners" of wealth, controlled by avarice, which operate to *rob* the toiling yeomanry of their heritage and homes.

Formerly, when the toiling yeomanry of America were prosperous and happy in the enjoyment of what their own toil produced, the sharpness of Yankee character was often quaintly illustrated by anecdotes drawn from imagination. In one it was related that the Yankee bargained away his soul for a boot full of gold, but kept his soul and got several bushels of the devil's gold by holding a soleless boot over a hole in the top of the well till the devil got discouraged and abandoned the bargain, after wheeling gold all night without detecting the "Yankee trick." Another time the Yankee stuck wires in the devil's swath, making him "wiffle-waffle."

Now all is changed, and the Yankee puts toil into the *soul*-less corporations of the country, and "wiffle-waffles," without looking for the cause of his trouble.

By official estimates of the people engaged in the vocations of life in the United States, about one-fifth are supported in office or as professional men, which, if they have a proportionate share of family, shows that each toiler having a wife and two children must contribute the support of one person belonging to the family of an officer or a professional person in addition to bearing the burdens of increased revenue, taxation, and corporate monopoly.

Prof. Stockbridge estimates the cost of fertilizers to produce one bushel of corn and fodder at forty-one cents. — N. H. Agricultural Report for 1877, page 333.

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The report of the Commissioner of Agriculture for 1878, pages 262–64, states the crop of corn and market price to the farmer as follows: —

State.	Bushels Corn.	Value per bushel.	Value crop Corn.	Less than value Fertilizers.
Delaware	4,500,000	$0.39	$1,755,000	$90,000
Kentucky	45,922,100	.40	18,368,840	459,221
Ohio	108,643,700	.33	35,852,421	8,691,496
Michigan	31,247,700	.38	11,874,126	937,431
Indiana	138,252,000	.27	37,328,040	19,352,280
Illinois	225,932,700	.25	56,483,175	39,149,232
Wisconsin	36,900,000	.29	10,701,000	4,428,000
Minnesota	17,106,900	.29	4,961,001	2,082,828
Iowa	175,256,400	.16	28,041,024	46,314,100
Missouri	93,062,400	.26	24,196,224	13,959,360
Kansas	81,563,400	.19	15,497,046	17,943,948
Nebraska	54,222,000	.16	8,675,520	3,555,500

Thus 1,012,609,300 bushels of corn in twelve States was worth $163,963,366 less to the farmers raising it than the market value of the fertilizers taken from the soil to produce the corn and fodder; and as the farmers in those States seldom return any fertilizers to the soil, future generations are to receive the soil from the stewardship of the present generation with the depletion sure to result from a continuance in that practice, which will not be claimed as much profit for the generations which are to follow in this country.

Webster says "The *profit* of the farmer, and the manufacturer, is the net gain made by the sale of produce or manufactures after deducting the value of the labor, materials, rents, and all expenses, together with the interest of the capital employed, whether land, machinery, buildings, instruments, or money."

By that test most of the farmers of America, instead of being freemen, would be in jail for debt to their capital, for very few of them are able to double their capital every twelve years. A laborer would be pronounced extravagant who failed to support

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his family in as good style as farmers' families live, if the laborer toiled as many hours, and as diligently as the farmer must toil, receiving fair compensation for his toil.

Wealth is only produced by toil, and of right belongs to the toiler.

Fortunes were filched from the toilers by force and delusion, piracy, pillage, and robbery in times and countries when and where force and prowess were the arbiters of personal rights.

Civilization changed the arbiter of personal rights from force to reason. Relentless avarice, by schemes no better than *conspiracy* if better than *piracy*, accumulates riches without producing them, which is no gain to the aggregate community.

The serpent which entered the garden to beguile, the satan who was going to and fro in the earth, the devil who offered the kingdoms of the world for homage, and insatiate avarice, which deprives mankind of comfort by subtle schemes, all are the arch foes of man and happiness. The peasant, prince, statesman, or prelate who wastes his energy in valiant attacks on the ghosts of the ancient trio, and blinks at the machinations of the foe of the present, is a blind leader not trustworthy. The serpent, by beguiling in the garden, entailed toil on mankind, and whatever increases toil or suffering, by delusion, deserves a crushed head by the heel of man.

If agriculture depletes the soil as is indicated, to put American agricultural products into foreign markets is matching the labor of American freemen with the "pauper toil of Europe,"— "penny wise and pound foolish," — "saving at the spigot while wasting at the bung," — a sure way to kill the goose which nature provided to lay the golden egg of sustenance for future generations in America.

The farmer's duty is to replenish and subdue the earth, and, as faithful stewards, to transmit it unimpaired to generations yet to follow as their heritage by divine right.

To perform his duty the farmer must crush the serpent's head, — holding the spear in one hand while rebuilding the wall with the other, — "pray and keep his powder dry."

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NOTE.

THE printing of this volume has been so long delayed that several chapters which were prepared for it have been omitted, as too much out of date. These include reports of State, county, district, and town societies, for the year covered by the report. They also include town statistics, which will be increased by the returns for the year 1880, and printed in the forthcoming volume, in connection with census statistics of the State. This report will be ready for the printer in May, and, it is hoped, be completed and delivered during the coming June session of the legislature.

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INDEX.

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INDEX.

Acreage....22, 257
Adornment of farmers' homes....535
Agriculture, English....255
Agriculture, highland....231
Agriculture, New Hampshire....13
Agricultural laborer....262
Albuminoids, ratio of....179
An outbreak at Haverhill....391
Analysis, experiments, etc....307
Analysis....168
Analysis, hay....181, 317
Analysis, grass....316, 318
Analysis, swale hay....180
Analysis, Indian corn....314
Analysis, guano....308
Analysis, swamp muck....312
Anatomical changes....444
Antiquity, implements of....350
Application of manure....200, 510
Apple, the....137
Apples....315
Apple, Calef sweet....333
Art of selecting stock....87
Atmosphere, the....285

Bare fallow....202
Bastard escutcheons....98
Benefit of fairs....495
Board, meetings of the....13
Bone, ground....309
Brown Harry....337
Bulls....102
Butter, palm-nut meal for....172

Calef sweet apple....333
Caribbean guano....308
Capital required....371
Carbo-hydrates, ratio of....179
Cases in Auburn....388
Cases in Rumney....388
Carding steers....170

Digitized by Google

Care in fruit-culture 140
Causes of glanders 454
Chemicals 185
Chemicals on corn and potatoes 324
Chemicals, how to use them 330
Cirrus 292
Classes, different 92
Clouds 292
Clover-hay 228
Compounds 315
Concentrated privy guano 309
Contagion 458
Contrast of agricultural systems 255
Co-operative experimental work 213
Comparative cost of stalks of corn 329
Corn-field 149, 190
Corn-raising 189
Corn, Indian 313
Crops, field 498
Cross-bred sheep 335
Culture, fruit 133
Cultivating crops, implements for 363
Cumulus, the 293

Dairy management 208
Dairy experiments 326
Danger of infection in our unfenced ranges 422
Disease among animals 375, 405
Disease in Hampstead 379
Does farming pay 483
Dr. Lyman's report 397
Duty of the farmer 543

Early or late cut hay 165
English agriculture 255
Escutcheons 90
Escutcheons, bastard 98
Essays and other papers 85
Experiments 178, 216, 319, 322, 325
Explanations 190
External glanders 437

Facts, interesting 328
Farcy 437
Farmer's duty 543
Farm laws 105
Farm implements, value of 371
Farming attractive to young men 485
Farm experiments 165
Farm machinery 349
Farm buildings 478
Fattening period 207
Fermented manures 201
Fertilizers 320
Fertilization of soil 192
Fertilization, result of 194

Digitized by Google

Fertilization, profit and use of 199
Fertilizer-spreader 358
Field-mice 142
Field-crops 498
Food, value of 203
Fruit-culture 133

Gathering and preserving fruit 147
Glanders-cells in the mucous membrane 451
Glanders-ulcers 452
Glanders and farcy 431
Glanders-catarrh 450
Granges 468
Grange papers 473
Good crops, witchcraft of 372
Goods from H. J. Baker & Co.'s, New York 310
Greatest danger to our stock 417
Guano 309
Guenon's system 90

Harvesters 367
Hay, early or late cut 165, 221
Hay, analysis of 317
Hay and meal 174
Highland agriculture 231
How to foretell storms 296
How to use chemicals 330
How to improve farms 473
Husbandry, patrons of 465

Implements in farming 370
Implements for dairy 370
Implements for soil 356
Implements for cultivating crops 363
Implements of antiquity 350
Importance of stock 525
Indian corn 314
Interesting facts 307, 328
Introduction and review 7
Irregularity of storms 294

Kerwin's ground bone 309

Landlord, the 258
Little things 530

Machinery required 353
Management of dairy 208
Manure 200, 510
Manure from food 202
Material value of farm implements 351
Meal or hay 174
Meetings of the board 13
Meetings in Coos county 14
Meeting in Webster 16
Meetings in Andover and Wilmot 25
Meeting in Keene 31

Digitized by Google

Meeting in Langdon 31
Meeting in Cornish Flat 31
Meetings in Deering and Lyndeborough 38
Meetings in Center Harbor and Sandwich 31
Meeting in Chester 41
Meetings at Northwood and Bow Lake 46
Meeting at Littleton 50
Meeting at Lisbon 56
Meeting at North Haverhill 60
Meeting at Amherst 66
Meeting at Bedford 71
Meetings at Plaistow and North Hampton 76
Meeting at Suncook 78
Meetings at Durham and elsewhere 80
Meter-table 247
Meteorology 281
Metric system 239
Milk, feeding on 202
Milk 529
Mitchell's superphosphate 310
Muck and peat 311

Nasal glanders 432
Nasal gleet 439
Nature of glanders 444
Needs of New Hampshire farmers 273
Never prune in wet weather 145
New Hampshire farming 492
Nimbus, the 294
Notes of the secretary 373

Orchilla or Caribbean guano 308
Outlook of agriculture 339

Palm-nut meal for butter 172
Pasture improvement 508
Patrons of husbandry 465
Peach, the 133
Peat 311
Popplein's phosphate 319
Potash the manure of the crop 198
Potash 320
Preventive measures demanded 425
Privy guano 309
Profit in use of fertilizers 199
Proximate analysis of hay 317
Pruning 143
Pruning young trees 138
Pulmonal glanders 436

Relation of machinery to farming 352
Relative dangers of poisons 421
Report 391

Seeding-machines 360
Sheep-husbandry 523
Signs of rain 297
Silicated phosphate 319

Digitized by Google

Soluble nitrogen compounds 315
Special fertilizers on potatoes 320
Specific diseases of animals 405
State grange 467
Subordinate granges 468
Sugar-beet 319
Superphosphate 310
Swamp muck 312

The adornment of farmers' homes 535
The farmer's duty 543
The greatest danger to our stock 417

Value of machinery 351

Witchcraft in crops 372
Wind 287

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